To the Graduate Council:

I am submitting herewith a dissertation written by George Braungart Yancey entitled "Arousal and the Motivation-Performance Relationship." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Industrial/Organizational Psychology.

Michael C. Rush

Michael C. Rush, Major Professor

We have read this dissertation
and ~~recommend~~ its acceptance:

Accepted for the Council:

Vice Provost
and Dean of The Graduate School

AROUSAL AND THE MOTIVATION-PERFORMANCE RELATIONSHIP

A Dissertation

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ABSTRACT

Both the effort-performance and incentive components of expectancy theory have proven to be effective predictors of performance. Many psychologists, however, seem to share an implicit assumption that performance is an increasing monotonic function of each of these two factors. This assumption was challenged in this study. By proposing a link between incentive and arousal, it was suggested that an individual's level of incentive may be increased to a point where the individual becomes overaroused and suffers a decrease in performance.

Incentive and arousal measures were administered to 111 high school age United States Swim club members during a regular season meet and during a championship meet. In addition, their performance in their best event was recorded for the regular season meet and for the championship meet. Effort-performance expectancy, trait anxiety, and biographical variables were also measured. The swimmmers were expected to be near their optimal level of arousal during the regular season, and incentive increases in the championship were expected to increase the swimmers' level of arousal to a point of overarousal during the championship.

A negative, nonlinear (in the shape of an inverted U) relationship between change in arousal and change in performance was found. In addition, change in incentive was positively related to change in arousal and negatively related to change in performance. Although

change in arousal was expected to mediate the relationship between change in incentive and change in performance, change in incentive influenced change in performance independent of change in arousal. Additional findings suggested that effort-performance expectancy might be negatively related to arousal, that the dynamics of the motivation-arousal-performance relationship seem to operate across gender, age, and years of experience, and that trait anxiety may, like task complexity, moderate the arousal-performance relationship.

The findings of this study were integrated with past research to develop a model of the motivation-arousal-performance relationship. By pointing out the integral role of arousal, it is hoped that the model proposed in this study will serve to enhance existing models of the motivation-performance relationship.

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CHAPTER I

INTRODUCTION

In their 1976 review of motivation, Campbell and Pritchard observed that studies of motivation have generally avoided any real analysis of performance since motivation is but one of the many determinants of performance. While theories of motivation have not tried to explain performance explicitly, they tend to share an implicit assumption that performance is a monotonically increasing function of motivation, other determinants of performance being equal. This assumption may be incorrect in some cases. Over two decades ago, Vroom (1964) postulated three possible relationships between motivation and performance: (1) performance as a monotonically increasing function of motivation, (2) performance as a negatively accelerated function of motivation, and (3) performance as an inverted U function of motivation. The purpose for this study is to explore the viability of Vroom's last hypothesis. In other words, to determine whether under certain circumstances motivation can be so high that performance is actually impaired.

There is reason to believe that an individual's motivation to try hard is related to his or her arousal level. It has also been demonstrated that high levels of arousal can impair performance (Browne & Mahoney, 1984), especially the performance of complex tasks

(Yerkes & Dodson, 1908). Thus, it may be that when an individual's level of motivation gets too high, he or she will experience an associated high level of arousal, and a resultant decrease of performance, especially when performing a complex task.

The specific purpose for this study is to investigate whether performance is an inverted U function of motivation in certain situations; and, if it is, to further examine the role of arousal as an intervening variable in that relationship. What those certain situations are that encourage an inverted U relationship between performance and motivation and why arousal might act as an intervening variable are topics that will be addressed in the following Literature Review.

CHAPTER II

LITERATURE REVIEW

A. Expectancy Motivation

Any study of the relationship between motivation and performance is influenced by how motivation is initially defined and measured. The literatures of both psychology and organizational behavior have produced many definitions of motivation. For the purposes of this study, motivation is defined within an "expectancy theory" framework. This theory is emphasized because it seems to best explain the relationship between motivation and performance.

The general concept of expectancy, that a behavior is more likely to occur if the individual believes (or expects) that the behavior will lead to a goal or some positive outcome, has played an important role in a number of theories of motivation. Two recent theories of expectancy that are influential in the fields of organizational behavior and psychology are Bandura's theory of self-efficacy and Lawler's expectancy theory of motivation.

According to Bandura (1977), motivation depends on two kinds of expectations about the future: efficacy expectations and outcome expectations. Bandura (1977, p. 193) defined an outcome expectation as "a person's estimate that a given behavior will lead to certain

outcomes." He defined an efficacy expectation as "the conviction that one can successfully execute the behavior required to produce the outcomes." Both expectations influence motivation. For example, if a baseball player has a clause in his contract that should he lead the league in homeruns he will receive a $50,000 bonus, his efficacy expectation would be the extent to which he believes he can lead the league in homeruns given his ability, the competition's ability to do better, and good or bad luck. His outcome expectation would be the extent to which he believes that management will honor its end of the contract and pay him the bonus if he does indeed lead the league in homeruns.

Lawler (1973) approached the concept of motivation somewhat differently from Bandura by adding an additional component, outcome valence. Lawler is in agreement with Bandura in his belief that for an outcome to be motivating, an individual needs to perceive a link between his or her performance and the outcome. Bandura labelled this perceived link an outcome expectation, while Lawler labelled it a performance-outcome expectancy. However, Lawler is not in agreement with Bandura in his (Lawler's) belief that performance-outcome expectancies are insufficient as an explanation for the motivating effects of outcomes, for Lawler believes that performance-outcome expectancies work in concert with outcome valences to determine whether an individual will be motivated by certain outcomes. Outcome valence is the importance or the value of an anticipated outcome, whether it will be pleasing or aversive, important or unimportant, or

simply, the satisfaction an individual expects to derive from an outcome. To use the above example, assume that the ballplayer in question strongly believes in his chances to lead the league in homeruns (his efficacy expectation is high), strongly believes that if he leads the league in homeruns he will receive his $50,000 bonus (his outcome expectation is high also), but, for reasons known only to him, the extra $50,000 is of no importance to him (the outcome valence is zero, neither negative nor positive). Thus, although the bonus has a high outcome expectation, it provides no motivation because it has no value for the player. Lawler is in agreement with Bandura about the importance of self-efficacy, although Lawler labelled that perceived link between effort and performance effort-performance expectancy. Thus, one's present motivation depends on one's belief that they can "successfully execute the required behavior" (effort-performance expectancy) and on their belief that successful behavior will be followed by valued outcomes (incentive).

B. Expectancy Motivation and Performance

In their 1976 review of motivation, Campbell and Pritchard (p. 86) commented that, "strictly speaking, the expectancy model [of motivation] does not try to explain performance, since there are many determinants of performance besides motivational ones." While some expectancy theory studies have used performance as a dependent variable, the tasks have been, according to Campbell and Pritchard:

> very simple and repetitive tasks for which the explicit or implicit assumption has been that individual differences in performance should reflect primarily effort differences and not differences in skill, aptitude, or task understanding. (p. 86)

In these studies where the tasks were simple and repetitive, performance was seen as an increasing monotonic function of motivation.

While a few expectancy theorists have developed reasonably explicit models that relate motivation to performance (e.g., Porter and Lawler, 1968), these models do not seem to completely address the nature of the relationship between motivation and performance. Presumably, these models reflect the prevailing wisdom that performance in an increasing monotonic function of motivation. In the current study, however, a distinction is made between the performance of complex tasks and the performance of simple and repetitive tasks. While the latter, the performance of simple and repetitive tasks, has been shown to be an increasing monotonic function of motivation, less is known about the relationship between the performance of complex tasks and motivation. In the current study, the relationship between the performance of a well-learned, complex task and incentive is investigated in order to examine whether high levels of incentive can actually impair performance. In other words, to determine whether performance may be nonlinearly related to incentive.

The results of one study which examined the relationship between motivation and the performance of complex tasks suggested that the relationship between motivation and performance may not always be a positive linear one. In their study of professional baseball and basketball championships, for example, Baumeister and Steinhilber (1984) found that increases in "motivation" actually impaired performance. They discovered that in the deciding games of championship series, when the rewards for successful performance were the greatest, the home team more often lost and committed more mistakes (fielding errors in baseball and missed free throws in basketball). The researchers assumed that the home team's motivation for self-presentation (a process of claiming desired identities through social, public performances; Schlenker, 1980, 1982) was greater than the visiting team's, and that the greater motivation led to poorer performance. The home team supposedly had more self-presentation motivation because supportive audiences engender self-presentation concerns while hostile or unsupportive audiences do not (Schlenker,1982).

Although not a focus of their study, Baumeister and Steinhilber's results also indicated that both the winning and the losing teams experienced more fielding errors and poor free throw shooting in the seventh and deciding game (when incentive was greatest) than in the initial games of championship series. Thus, Baumeister and Steinhilber's findings indicate that the relationship between performance and motivation may be more complex (in the form of an

inverted U) when the tasks are complex (fielding or free throw shooting) and the incentives are large (world championship, thousands of dollars, and national recognition).

The present study is predicated on the assumption that the performance of complex behaviors may deteriorate when extremely valuable incentives are tied to successful performance. Further, it is also assumed that increases in incentive lead to increases in arousal, and it is the condition of overarousal, brought about by large incentives, which may cause the subsequent drop in performance.

C. The Concept of Arousal

There are two aspects of motivated behavior that stand out among others, (1) motivated behavior is goal oriented, in that the individual acts with a sense of purpose or direction, and (2) motivated behavior is often carried out at a higher level of intensity than non-motivated behavior (Steers & Porter, 1979, p. 6). This latter aspect of motivated behavior is of particular interest with respect to this section, for the concept of arousal appears to offer promise of explaining why some behaviors are carried out in a more intense and energetic manner than other behaviors.

While, according to Thompson (1975, p. 296), "little is known about the biology of complex human motives," much has been discovered about the biological mechanisms of arousal. Donald Lindsley's activation

theory (1957) laid the groundwork for the study of arousal. According to Lindsley, the continuum extending from deep sleep at the low activation end to "excited states" at the high activation end is very largely a function of cortical bombardment by the Ascending Reticular Activating System (ARAS), such that the greater the cortical bombardment the higher the activation. Thompson (1975) described the reticular formation as follows:

> Many of the anatomical characteristics of the brain stem reticular formation have been known for some time. Cajal described it in 1909 as a ventral (situated on the abdominal side of the body) core of neural tissue that extended from the spinal cord to the thalamus and was composed of intermingled cell bodies and fibers having the appearance of a reticulum (network). The reticular core is surrounded by the long ascending fibers and systems of the classical sensory pathways and the descending motor pathways. (p. 436)

The reticular formation consists of a dense network of neurons with short fibers and multiple relays. Consequently, it does not preserve information about location and quality of stimulation as do the specific sensory systems (Scott, 1966, p. 7). Thompson (1975) explained the relationship between the specific sensory systems and the reticular formation as follows:

> There are two general types of sensory systems: the specific systems concerned with vision, hearing, touch, etc. and an older nonspecific system involving the reticular core of the brain stem. The reticular system is influenced or activated by all varieties of stimuli and is concerned more with regulating the general level of activation or arousal of the organism than with the details of sensory information. (pp. 173-174)
>
> The reticular activating system appears to provide the missing link between the classical sensory systems of the

> brain and many nonspecific behavioral phenomena subsumed under headings like alertness, attention, arousal, sleep, etc., that seem to be related to sensory activation but not necessarily to any specific type of stimulation. (p. 436)

The reticular formation is comprised of two systems: The lower or brain stem reticular formation (BSRF) and the upper or thalamic reticular formation (TRF). The properties of the BSRF are more germane to the study of work motivation and performance (Scott, 1966, p. 8).

Lindsley, Bowden, and Magoun (1949) and French and Magoun (1952) discovered that lesions in the BSRF produced a chronically comatose animal, incapable of arousal, even with the classical sensory pathways intact. Furthermore, electrical stimulation of the BSRF arouses a sleeping animal (Worden & Livingston, 1961). Also, stimulation of any receptor, interoceptive or exteroceptive, increases BSRF activity, which in turn, produces a diffuse activation pattern in the cortex (Lindsley, 1957; Samuels, 1959). Bernhaut, Gellhorn, and Rasmussen (1953) found that the most intense and widespread cortical arousal pattern was produced by painful stimuli, followed by proprioceptive, auditory, and visual stimuli. Activation level is also influenced by the intensity, complexity, uncertainty, and meaningfulness of the stimuli (Scott, 1966, pp. 11-12).

Arousal, of course, is an inferred or hypothetical construct. Objective measures such as EEG arousal cannot be taken as direct measures of hypothetical general arousal but rather as possible

indicants. A widely accepted approach to defining arousal is to use a set of measures - EEG, autonomic, and behavioral - to characterize and quantify the arousal syndrome (Thompson, 1975, p. 428).

Although arousal may be defined by several physiological measures, Lacey and Lacey (1958) found that physiological measures are seldom related to one another, to psychological measures of state arousal, or to the intensity of the stressor. In her review of the arousal literature, Duffy (1962) suggested four reasons for why physiological measures of arousal do not correlate highly with one another: (1) the physiological responsiveness of individuals to environmental stimuli are to some extent person-specific, (2) when the organism is activated, different physiological systems may act in compensatory fashion in order to maintain homeostatic balance, (3) physiological systems have different response latencies and times for reaching response limits, and (4) some physiological systems may be more representative of total organismic activation than others. Martens (1977, p. 103) suggested that arousal can best be measured with a self-report inventory for the following reasons: (1) it can be administered quickly and easily, (2) it presents no difficulties in group administration, and (3) it is more reliable than physiological measures; it is less affected by extraneous factors in the environment. For these same reasons, the self-report approach was also employed in the current study.

D. Arousal as a Function of Motivation

Recently, most psychologists have ignored the importance of arousal in the study of motivation. Vroom (1964), however, commented on it in passing:

> There are two somewhat different kinds of questions which are typically dealt with in discussing motivation. One of these is the question of the arousal or energizing of the organism. Why is the organism active at all? .... The second question involves the direction of behavior. What determines the form that activity will take? (p. 8)

Two notions, "drive" and "arousal", have been used to explain this first component of motivation, the "energizing of the organism". It is the second concept, "arousal", which has shown the most promise as an explanatory concept. However, it should be noted that the studies on which this conclusion is based are animal studies for the most part. Earlier theories of motivation dealt with the question of what energizes the organism with the concept of "drive". In their review of motivation Campbell and Pritchard (1976, p. 73) stated, "The concept of drive has not proven useful in explaining experimental results and the preponderance of opinion is that it should be discarded." They went on to explain, however:

> It may yet be possible to preserve its [drive's] role as a general behavioral energizer if we root it firmly in an organism's physiological functioning. In this form, drive level has been defined as arousal or activation level and has spawned a very recent but large and growing literature. We can thus ask questions concerning the locus of arousal and <u>how it interacts with rewards and incentives to influence behavior</u> [italics added]. (p. 72)

One answer to this question of how arousal influences behavior may be to assume that arousal is an increasing monotonic function of rewards and incentive. There is physiological and behavioral support for this assumption. The physiological evidence that will be presented pertains to primary motives such as hunger, thirst, and sexual desire, as the biology of complex, "derived" motives is little understood. While the examination of primary motives cannot lead to any firm conclusions about the relationship between complex motives and arousal, by showing that the stimulation of primary motives causes an increase in arousal, the assumption that the stimulation of more complex motives causes an increase in arousal gains support.

Physiological Evidence

The hypothalamus area of the brain is of critical importance in the control of primary needs (such as eating, drinking, and sexual behavior) and emotional behavior. For example, stimulation of the the ventromedial nuclei of the hypothalamus causes an individual to restrain from eating, while stimulation of the lateral nuclei causes an individual to desire to eat (Chaplin & Krawiec, 1974, p. 530). There is also a relationship between appetite and emotional behavior. For example, Ingram (1956) found that cats with lesioned ventromedial nuclei not only ate excessively but were savage as well, while cats with lesioned lateral nuclei not only refused to eat but were placid as well. The hypothalamus is also closely related to the ascending reticular activation system (ARAS), anatomically and functionally, and

stimulation of the ARAS is directly related to an organism's arousal level. The hypothalamus also influences various nuclei in the brain stem which directly control the autonomic nervous system (ANS). The autonomic nervous system is, according to Thompson (1975, p. 377), "the peripheral motor system for the brain structures most directly involved in the mediation of emotional and motivational aspects of behavior." Thus, the hypothalamus, which is so important in controlling our primary needs and our emotions, is also related to biological structures such as the ARAS and the ANS which are directly related to arousal.

When an individual is motivated by some primary need, his or her entire body can be mobilized to achieve the desired goal. Thompson (1975) commented on how motives can influence arousal by activating the sympathetic division of the autonomic nervous system:

> The autonomic nervous system consists of two divisions, the sympathetic and the parasympathetic. The sympathetic division of the autonomic nervous system acts as an arousal mechanism for the whole body and can prepare for vigorous action. It is important to note that the individual need not actually engage in vigorous activity to produce sympathetic effects. The mere thought of a fight activates the sympathetic division [italics added]. The effect of this thought would be to increase heart rate and respiratory depth, halt gastrointestinal activity, release glucose stores, shunt blood away from viscera and skin into the muscles, and start sweat glands operating.... In short, the sympathetic division can act rapidly to prepare the organism to "fight or flee" in the face of perceived danger. (pp. 375-376)

The relationship between the hypothalamus and the sympathetic division of the autonomic nervous system shows that arousal tends to follow motivation causally, and more importantly, that cognitions of an event can trigger arousal effects.

Behavioral Evidence

While the sympathetic division of the autonomic nervous system apparently evolved to aid us in fighting or fleeing from physical dangers, it can be activated by less dangerous situations where only our egos or sense of personal adequacy is threatened. The behavioral evidence suggests that the presence of social or self-mastery rewards (for example, in competitive situations where doing well can lead to social approval and self approval) can increase arousal levels.

It has been found in the sport psychology literature (Pierce & Stratton, 1981; Fisher & Zwart, 1982; Gould, Horn & Spreeman, 1983), for example, that arousal is a product of fear of performing poorly (which indicates the presence of self-mastery rewards) and fear of evaluation (which indicates the presence of social rewards). Also, subjects who perform before an audience, especially an evaluative audience that will reward successful performances but not unsuccessful performances, experience more arousal than subjects who do not perform before an audience (Zajonc & Sales, 1966; Cottrell, Wack, Sererak & Rittle, 1968; Hency & Glass, 1968).

Not only can the introduction of social and self-mastery incentives increase arousal, but the strength of the arousal response appears to be related to the strength of the incentives. The greater the perceived threat to an individual's sense of personal adequacy, the more arousal he or she will presumably experience. For example, Lowe and McGrath (1971) found an increase in measures of physiological arousal when little league baseball players were playing in a game of critical importance. Gould et al. (1983) found that wrestlers competing in a junior national championship reported that participation in the championship meet was a major source of stress (a concept related to arousal). In sum, increasing levels of social and self-mastery incentives appear to be related to increasing levels of arousal.

E. Arousal and Performance

Browne and Mahoney (1984) explained that relationship between arousal and performance is considered to be in the shape of an inverted U. In their words:

> Although debate has arisen over the best model for understanding the effects of different levels of arousal on performance - one based on the Yerkes-Dodson inverted-U (1908) or the updated drive theory model (e.g., Malmo 1959) - most psychologists conceptualize the performance-arousal level relationship within the inverted-U frame of reference. (p. 613)

According to Hebb (1966), as an individual's level of arousal increases from very low levels to moderate levels, the individual experiences a corresponding change in his or her "degree of integrated behavior" from sleeping to waking, from waking to increasing alertness, and from increasing alertness to optimal performance. As an individual's level of arousal increases further from moderate levels to extremely high levels, the individual's "degree of integrated behavior" decreases from optimal performance to emotional disturbance, and from emotional disturbance to disorganization.

With regard to the inverted U relationship between arousal and performance, Broadbent (1971, p. 425) noted, "There is no problem to explain low performance at the bottom end of the arousal scale." [And, as if in answer, Browne and Mahoney (1984, p. 613) wrote, "Underarousal is usually considered a problem with motivation and is dealt with accordingly."] "But there is a considerable problem in explaining poor performance at the top [of the arousal scale]." The issue of overarousal and concurrent low levels of performance is the focus of the present study.

The level of arousal which corresponds to optimal performance depends on the nature of the task and the nature of the individual performing the task. With respect to the individual, because high trait anxious individuals tend to function at higher levels of state anxiety (Speilberger, 1966) than low trait anxious individuals, optimal performance may be at a higher level of arousal for the high

trait anxious individuals, as state anxiety is closely related to arousal. With respect to the task, arousal seems to be more debilitating for complex tasks than for simple tasks (Yerkes & Dodson, 1908). Oxendine (1970), for example, found that optimal performance was related to high arousal levels for strength-oriented sports such as weightlifting, but that optimal performance was related to low arousal for skill-oriented sports such as golf. Thus, it would seem that overarousal is more likely to occur when individuals are performing a complex rather than a simple task, and when the individuals are more susceptible to the debilitating effects of arousal. In the following paragraphs, the question of why high arousal can cause poor performance is examined, followed by a discussion of the role played by trait anxiety in the arousal-performance relationship.

Overarousal manifests itself in various ways, causing a variety of symptoms: emotional, attentional, psychological, and physical changes. It is these very changes which can be seen to affect and thereby lower performance. These symptoms and their subsequent effects on performance are described below.

Symptoms of Overarousal

Emotional Symptoms: Worden and Livingston (1961) reported that when the BSRF received high electrical voltages, animals not only woke up, but vocalized and showed signs of negative affect. With even

higher voltages, they reported that animals showed abrupt arousal, extreme agitation, escape responses, and behavioral disorganization. These extreme emotional reactions brought about under conditions of high arousal would be likely to impair the performance of most tasks, especially those fairly complex tasks which require a degree of emotional control.

Attentional Symptoms: Easterbrook (1959) found that conditions of overarousal lead to a reduction in focused attention and concentration on relevant task cues. Nideffer (1979) expanded on Easterbrook's findings in his investigation of the attentional processes used in sports. Nideffer classified attention along three dimensions: width, direction, and the ability to switch. Width was described as broad or narrow. A situation where broad attention is needed would be bringing a basketball down the court, where one must attend to a great amount of information. In shooting the basketball it is necessary to narrow attention and ignore all the activity going on around oneself. Direction was described as internal or external. To use the example of the athlete shooting the basketball, if the athlete's attention was externally directed, he or she might be focusing on the sight of the basket and the sound of the approaching defensive player. If the athlete's attention was internally directed, he or she might be focusing on such internal thoughts as, "If I make this basket, I'll be the hero," or on such internal feelings as tired legs or a knotted stomach. Nideffer has found that as arousal increases a player has a tendency to use the attentional style that is his or her strength. As

peak athletic performance demands the ability to change attention style to meet the demands of the situation, this attentional inflexibility that arousal creates can decrease performance. Further, as arousal increases even more, attention begins to narrow and then involuntarily to be directed internally. As Nideffer (1979) described this situation:

> The person becomes distracted by his own bodily feelings (beating heart, muscle tension, and so on) and his thoughts (why did the runners leave the base, what's the matter with me, I might choke, and so on). As attention is directed internally, the ability to concentrate on the game deteriorates. (p. 106)

Psychological Symptoms: In addition to an inappropriate shift in attentional style, overarousal can decrease an individual's feelings of self efficacy or confidence. According to Bandura (1977, p. 195), physiological arousal is a major determinant of self efficacy - "the conviction that one can successfully execute the behavior required to produce the (desired) outcomes." He explained:

> Because high arousal usually debilitates performance, individuals are more likely to expect success when they are not beset by aversive arousal than if they are tense and viscerally agitated. Fear reactions generate further fear of impending stressful situations through anticipatory self-arousal [italics added]. By conjuring up fear-provoking thoughts about their ineptitude, individuals can rouse themselves to elevated levels of anxiety that far exceed the fear experienced during the actual threatening situation. (pp. 198-199)

Physical Symptoms: Heightened arousal can also lead to many other reactions besides changes in attention or self-efficacy. If we

perceive something to be threatening in the environment, the autonomic nervous system is stimulated to prepare us for defense. Although this response, the fight or flight syndrome, evolved to help us against physical threats, any threat can bring on the response, whether it is our lives that are in danger or only our egos. Some of the autonomic responses include: increase in rate and strength of heartbeat, constriction of blood vessels and rise in blood pressure, increase in blood sugar and fatty acids, dilation of nostrils and bronchi, increased muscle tension, retraction of the eyeballs and dilation of the pupils, and shortened blood coagulation time to reduce the effects of any wounds (Diagram Group, 1976, p. E4).

Interaction of Symptoms: Nideffer (1981) has found that physical and psychological responses can affect one another. For example, Nideffer (1981, p. 151) considered an athlete who had cramps caused by muscle tension, the muscle tension being a physical response to the stress of competition. The cramps caused the athlete to worry, a psychological response. Worrying brought about a shift to a narrow-internal style of attention which impaired the athlete's performance. The resulting drop in performance created more musclular tension, hence more worry and a narrower and more internal attentional style, and finally, performance was impaired even more. A damaging feedback loop had been created.

The athlete in the above example felt the cramps first, followed by worry and a change in attentional style. The symptoms of overarousal,

however, may differ for each individual. Schwartz, Davidson, and Goleman (1978) found some people to react with somatic symptoms, some with cognitive symptoms, and some with both. To add to the complexity, Powell and Verner (1982) found in their study of parachutists that (not suprisingly) beginners were more anxious and performed poorer than more seasoned parachutists. In addition, they discovered that physiological measures of anxiety (or arousal) like heart rate were related to poor landings, while psychological measures like the State section of the State Trait Anxiety Inventory were related to poor plane exit skills. Thus, different manifestations of anxiety (or arousal) affected various components of the skill.

The relationship between arousal and performance is a complex one. This is not surprising as performance is multidimensional and arousal can influence a number of performance dimensions (e.g., emotional, attentional, physical, and psychological). Nonetheless, the research suggests that performance is an inverted U function of arousal level. By gaining insight into some of the antecedent conditions of the arousal-performance relationship, it might be possible to develop methods for dealing with the debilitating effects of too much or too little arousal.

The Role of Trait Anxiety

Trait anxiety may influence the role arousal plays in the motivation-performance relationship. Spielberger (1966) defined trait anxiety as a motive or an acquired behavioral disposition that:

> predisposes an individual to perceive a wide range of objectively nondangerous circumstances as threatening and to respond to these with state anxiety reactions disproportionate in intensity to the magnitude of the objective danger (p. 17)

Increasing social or self-mastery incentives may lead to more arousal because the individuals perceive a chance to enhance or hurt their egos, or feelings of personal adequacy. If this is true, trait anxious individuals should be especially susceptible to the arousing affects of increased incentives.

The State-Trait Anxiety Inventory, developed by Spielberger for measuring state and trait anxiety, is closely tied to ego-threatening situations (Spielberger, 1972). In other words, individuals who are high on trait anxiety are especially inclined to feel threatened and anxious when forced to risk their egos. Spielberger, Gorsuch, and Lushene (1970) found individuals who scored high on trait anxiety to experience more state anxiety than their low trait anxious counterparts under conditions where their self esteem was threatened or their personal adequacy was being evaluated.

Martens (1977, p. 5) defined state anxiety as "arousal produced by the perception of danger", either physical danger or danger to one's ego. Thus, it seems likely that high trait anxious individuals would be more prone to the performance damaging effects of overarousal, if possible ego threatening incentives (e.g., social or self-mastery) were tied to their performance. If this is the case, then it would be possible to predict whose performance would be more likely to suffer in highly motivating situations, and appropriate actions could be taken. For example, if a baseball coach had two equally adept pitchers available for a best of three series, he might want to use the more trait anxious one for game one where the incentive for winning is less.

F. Summary

In this section, a tentative model of the relationship between motivation and performance is described. Because this model attempts to incorporate existing theory and research along with new ideas about the motivation-performance relationship, this summary also includes evidence in support of old and new ideas.

Expectancy theory appears to offer the most promise of illuminating the role played by motivation in the motivation-performance relationship. It has been demonstrated that perceived incentives (the combination of performance-outcome expectancies and outcome valences) strongly influence subsequent performance (Campbell & Pritchard,

1976). Effort-performance expectancy also seems to strongly influence subsequent performance (Campbell & Pritchard, 1976; Bandura, 1977; Taylor, 1987).

Based on expectancy theory, incentive should not be related to performance if effort-performance expectancy is zero. Likewise, effort-performance expectancy should not be related to performance if incentive is zero. For this reason, the two variables have sometimes been combined multiplicatively. However, the actual utility of combining the components has not been supported by research (Campbell & Pritchard, 1976). It is suggested here that the two components, incentive and effort-performance expectancy, be treated separately instead of being combined because it is felt that they may affect performance in unique ways. In order to elaborate on how incentive and effort-performance expectancy may influence performance differently, it is necessary to review the role of arousal in the motivation-performance relationship.

Motivated behavior is usually characterized by its directed and energetic nature (Steers & Porter, 1979, p. 6). Expectancy theory is a useful tool for explaining the direction or form of motivated behavior, but not the energy or activity level of motivated behavior (Mitchell, 1982). Arousal is promising as an explanatory tool for this latter aspect of motivated behavior (Campbell & Pritchard, 1976, p. 72). One purpose for this study is to draw these two aspects of motivated behavior closer together. An assumption for this study is

that an increase in incentive should cause a subsequent increase in arousal.

Physiological research on primary motives indicates that motivation tends to precede arousal causally and that motivation and arousal are closely connected (Thompson, 1975). While the biology of complex motives is less well understood than the biology of primary motives, it has been assumed for the purpose of this study that the process for complex motives is somewhat analogous to the process for primary motives. In other words, motivation and arousal are assumed to be related, with motivation tending to precede arousal causally. Thus, the more directed an individual is toward reaching some goal, satisfying some need, or reaching some level of performance, the more energized he or she should become.

Behavioral studies of incentive and arousal generally support the contention that an increase in incentive will lead to an increase in arousal (Lowe & McGrath, 1971). Two kinds of incentive which seem to be strongly related to arousal are social incentives, the opportunity to be positively evaluated by others (Zajonc & Sales, 1966; Cottrell et al, 1968; Hency & Glass, 1968) and self-mastery incentives, the opportunity to be positively evaluated by oneself (Pierce & Stratton, 1981; Fisher & Zwart, 1982; Gould et al, 1983).

Effort-performance expectancy might also be related to arousal, but in a different way than incentive. Bandura (1977, p. 200) stated that,

"perceived self-confidence (effort-performance expectancy) can affect susceptibility to self-arousal." He explained:

> Individuals who come to believe that they are less vulnerable than they previously assumed are less prone to generate frightening thoughts in threatening situations. Those whose fears are relatively weak may reduce their self-doubts and debilitating self-arousal to the point where they perform successfully. (p. 200)

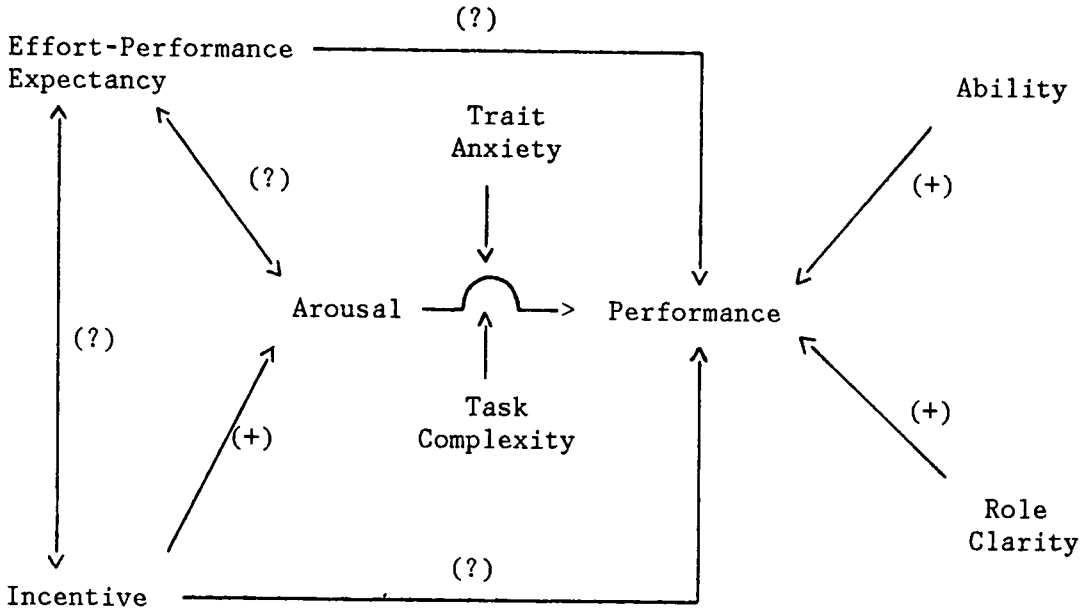
In other words, arousal might be a negative linear function of effort-performance expectancy. On the other hand, Bandura (1977, p. 195) also suggested that effort-performance expectancy might be a symptom of arousal, such that effort-performance expectancy should be highest when arousal is neither too high nor too low. Thus, the exact nature of the relationship between effort-performance expectancy and arousal is not well understood.

The presumed relationships between incentive and arousal and effort-performance expectancy and arousal may play an important role in the motivation-performance relationship, because performance has consistently been shown to be a nonlinear (curvilinear in the shape of an inverted U) function of arousal. Thus, incentive and effort-performance expectancy may, in part, influence performance through arousal, and thus, influence performance in nonlinear and possibly detrimental fashions.

If the arousal-performance relationship plays an important role in the motivation-performance relationship, as has been suggested,

moderators of the arousal-performance relationship may also be of importance. Two potential moderators are task complexity and trait anxiety. Yerkes and Dodson (1908) indicated that optimal performance occurs at lower levels of arousal for more complex tasks. This was supported by Oxendine (1970). Also, high trait anxious individuals tend to react to threatening situations with more arousal (state anxiety) than low trait anxious individuals (Spielberger, 1966), and trait anxious individuals feel especially threatened by ego threatening situations (Spielberger, 1970; Spielberger et al., 1972).

The purpose for conducting this study was to explore the nature of the motivation-performance relationship. A proposed model of the motivation-performance relationship depicted in Figure II-1 attempts to incorporate the expected results from this study with past research. The essential difference between this model and prior models is the inclusion of arousal as an intervening variable between motivation and performance. Another difference is the inclusion of possible moderators of the arousal-performance relationship such as task complexity and trait anxiety. One similarity between the proposed proposed model and prior models is the inclusion of two variables which have not been discussed up to this point: ability and role clarity. Steers and Porter (1979, p. 211) commented that performance is not just a function of motivation level, but is a function of ability and role clarity as well, and to neglect these two factors could lead to an incorrect assumption that motivation is the major predictor of performance.



Incentive is a function of
the sum of the products of
performance-outcome expectancies
multiplied by outcome valences.

Figure II-1. A proposed model of the motivation-arousal-performance relationship.

Propositions of the proposed model of the motivation-arousal-performance relationship on which the current study focuses are:

1. Arousal is a positive linear function of incentive, especially social and self-mastery incentive.
2. Performance is a nonlinear (curvilinear in the shape of an inverted U) function of arousal and is especially subject to the debilitating effects of overarousal when the task is complex.
3. The relationship between performance and incentive, especially social and self-mastery incentive, is mediated by arousal.
4. Because the incentive-performance relationship is mediated by arousal, performance is related to incentive in a curvilinear (in the shape of an inverted U) fashion and is most subject to the debilitating effects of too much incentive when the task is complex.

If the above propositions hold true, then an important implication would be that if an individual were optimally aroused, then an increase in his or her level of incentive could lead to a possible decrement in performance due to overarousal.

Additional questions suggested by the motivation-arousal-performance model which can be explored are the relationship between effort-performance expectancy and arousal, the relationship between effort-performance expectancy and performance, and the role of trait anxiety as a moderator of the arousal-performance relationship.

CHAPTER III

METHODOLOGY

A. Subjects

The participants in this study were high school age swimmers representing three United States Swimming (U.S.S.) clubs. It was felt that these subjects would adequately serve the purpose of investigating the effect of high levels of motivation on well-learned, complex tasks for three reasons. First, swimming at a competitive level is a complex task. Second, the task was well-learned. The swimmers, though young, were experts. They practice almost year round, many attending special classes to further develop their swimming techniques and skills. Third, the swimmers perform under highly motivating conditions. The U.S.S. clubs are involved in serious, year round competition. The ultimate goal of the clubs is to train our country's best swimmers for the Olympics and other international competitions.

These swimmers were evaluated once during a regular season meet and once during a championship meet. Of the 111 swimmers who participated in this study, 61 were male and 50 were female. As reported in Table III-1, the male swimmers were slightly older and more experienced than the female swimmers.

Table III-1

Descriptive Statistics of the Male and Female Swimmers.

Variable	Number of Responses	Mean	Standard Deviation	Minimum	Maximum
		Male Swimmers (n = 61)			
Years of Experience	58	7.26	2.74	2	12
Age	59	16.44	1.60	14	21
		Female Swimmers (n = 50)			
Years of Experience	47	7.02	2.02	2	12
Age	49	15.88	1.70	13	19

B. Measures

Social and Self-Mastery Incentive (INC)

Social and self-mastery incentives (hereafter referred to as incentive) was measured within an expectancy theory framework. The swimmers were asked to score the outcome valences and the performance-outcome expectancies for nine outcomes related to performing well (e.g., I will score points for my team) and for nine outcomes related to performing poorly (e.g., I will look bad in front of the spectators). Outcome valence was measured on a five point scale from 4 (extremely important) to 0 (unimportant). Performance-outcome expectancy measured the subjective probability (0 percent to 100 percent) that a given performance would lead to a given outcome. The total incentive score was determined by summing the 20 products of performance-outcome expectancies and outcome valences across all outcomes.

Change in social and self-mastery incentive was determined by subtracting each swimmer's incentive score during the regular season from his or her incentive score during the championship. A copy of the incentive instrument is provided in Appendix A along with information pertaining to its development.

Arousal (SAI)

Arousal was measured with a 20 item self report inventory, the State section of the State-Trait Anxiety Inventory (SAI). A four point scale (from "not at all" to "very much so") was used to answer questions about whether the swimmers felt calm or tense, comfortable or jittery, etc., immediately before they competed.

This test was chosen to measure arousal for three reasons. First, according to Martens (1977, p.5), "state anxiety as defined is closely associated with the concept of arousal." Second, as noted previously, there are several advantages to measuring arousal with a self-report instrument such as the SAI which is more reliable and less expensive and time consuming than physiological measures. Finally, the SAI has been successfully used as a measure of arousal in many other studies, especially in the sports psychology literature.

Test-retest correlations for the SAI are usually low. Spielberger et al. (1970, p. 9) explained, "Given the transitory nature of anxiety states, measures of internal consistency such as the alpha coefficient would seem to provide a more meaningful index of reliability of A-State scales than test-retest correlations." Spielberger et al. reported alpha coefficients ranging from .83 to .92 with higher values when the SAI was given under conditions of stress.

Change in arousal was determined by subtracting each swimmer's arousal score during the regular season from his or her arousal score during the championship. A copy of the SAI instrument is provided in Appendix B along with information about the validity of the SAI.

Performance

Performance was measured by each swimmer's time in his or her best event during a regular season competition and during a championship competition. In order to compare the times of male and female swimmers in different events, times were standardized within gender and within event according to the performances of all the participants at the large December 14-15, 1985 meet in Atlanta, Georgia. A mean of 500 and a standard deviation of 100 were used so that a performance score of 600 indicates that swimmer A, for example, a male in the 50 meter freestyle, was faster than 85% of the males who swam the same race at Atlanta on December 14-15, 1985. Change in Performance was determined by subtracting each swimmer's performance score during the regular season from his or her performance score during the championship.

Effort-Performance Expectancy (Expectancy)

Effort-performance expectancy was measured with a single item which asked for the subjective probability (from 0 percent to 100 percent) to the question, "if you try hard in this weekend's competition, how likely is it that you will swim some of your fastest times in your

best event?" Change in effort-performance expectancy was determined by subtracting each swimmer's effort-performance expectancy score during the regular season from his or her effort-performance expectancy score during the championship. A copy of this item can be found in Appendix A.

Trait Anxiety (SCAT, TAI, and Nervousness)

Trait anxiety was measured with three instruments: the Sports Competition Anxiety Test (SCAT), the Trait section of the State-Trait Anxiety Test (TAI), and the coaches' evaluation of the swimmers' nervousness or anxiety during competitions (Nervousness). The purpose of using the last instrument was to see whether the coaches perceptions of the swimmers' anxiety was similar to the swimmers' perceptions, as measured by the SCAT and the TAI. As this measure was only given once and has only one item, no psychometric properties have been established.

The Sports Competition Anxiety Test (SCAT) is made up of ten statements (e.g., Before I compete I feel uneasy). A three point scale (from "often" to "hardly ever") is used to respond to each statement. This instrument was chosen because it is a sport-specific trait anxiety inventory and was, therefore, likely to be a better predictor of state anxiety in a sports setting than a more general trait anxiety inventory, such as the Trait Anxiety Inventory (TAI).

Martens (1977) reported test-retest reliability coefficients for the SCAT ranging from .57 to .93 with a mean of .77. He also reported internal consistency coefficients (using Kuder-Richardson formula 20) ranging from .95 to .97. Martens also reported that the SCAT was moderately related to other anxiety measures, such as Levy's Children's Manifest Anxiety Scale (r=.28), Sarason et al.'s General Anxiety Scale for Children (r=.46), Spielberger's Trait Anxiety Inventory for Children (r=.46) and Spielberger's Trait Anxiety Inventory for Adults (r=.44). Martens also reported on a number of laboratory and field studies which supported the construct validity of the SCAT. Basically, it was found that the SCAT was more effective in predicting state anxiety in sports settings than in other settings.

Spielberger et al. (1970) reported test-retest reliabilities for the TAI ranging from .73 to .86. Alpha coefficients ranged from .86 to .92 for the TAI. They also reported evidence of convergent validity. Correlations of the TAI with the IPAT Anxiety Scale ranged from .75 to .77. Correlations of the TAI with the Taylor Manifest Anxiety Scale ranged from .79 to .83. Finally, correlations of the TAI with the Zuckerman Affect Adjective Checklist ranged from .52 to .58. Copies of the three trait anxiety measures are provided in Appendix C.

C. Procedure

The swimmers compete eleven months out of the year. The competitions build from regular season meets to championship meets

during each season. Each swimmer completed a motivation questionnaire (which assessed both effort-performance expectancy and social and self-mastery incentive) and an arousal questionnaire during a regular season meet and again during a championship meet. In addition, before a practice session near the end of the season, approximately a half of the swimmers completed two trait anxiety questionnaires, the SCAT and the TAI, and an arousal questionnaire. At this time, the coaches were asked to complete the Nervousness questionnaire, which asked for an assessment of each swimmer's nervousness before competitions, at their leisure.

The state section of the STAI (SAI) was administered to the swimmers by their coaches on the same day the swimmers competed. Before the start of the competition, the swimmers were asked to name their best event. Soon after having completed their best event, they were asked to fill out the SAI, which assessed their general arousal immediately prior to the start of the race. This instrument was completed twice by each swimmer, once following a regular season race and once following a championship race.

The motivation questionnaire, which assessed effort-performance expectancy and social and self-mastery incentive, along with the biographical questionnaire, which assessed the swimmers' best event, age, sex, and years of experience, were administered to the swimmers by their coaches on the same day as, but prior to, the competition.

These questionnaires were completed twice by each swimmer, once before a regular season meet and once before a championship meet.

The swimmers' time in their best event was recorded on two occasions, once for a regular season meet and once for a championship meet. As noted, each swimmer indicated what his or her best event was on the biographical questionnaire that was filled out before the start of the meet. If a swimmer swam in more than one heat of his or her best event, the last heat peformed was recorded. Performance times were obtained from computer printouts produced by the directors of each swim meet.

D. Hypotheses

The motivation-arousal- performance model partially tested in this study was depicted in Figure II-1 in the Literature Review. Two implications of that model are that (1) an individual's performance is a nonlinear (curvilinear in the shape of an inverted U) function of his or her arousal level and (2) an individual's arousal level is a positive linear function of his or her level of incentive. In order to examine these implications within-subject, as would be suggested by the expectancy theory of motivation, it was neccasary to measure each swimmer's change in incentive, arousal, and performance. Accordingly, four major hypotheses were derived:

1. There will be a positive linear relationship between the swimmers' change in arousal ($\triangle$ARS) and their change in social and self-mastery incentive ($\triangle$INC).

2. There will be a negative linear relationship between the swimmers' change in performance ($\triangle$Performance) and their change in arousal ($\triangle$ARS) with the addition of a curvilinear component in the form of an inverted U.

3. There will be a negative linear relationship between the swimmers' change in performance ($\triangle$Performance) and their change in social and self-mastery incentive ($\triangle$INC) with the addition of a curvilinear component in the form of an inverted U.

4. The relationship between change in performance and change in social and self-mastery incentive, described in hypothesis 3, will be mediated by change in arousal. In other words, change in social and self-mastery incentive ($\triangle$INC) will contribute little to the variation in change in performance ($\triangle$Performance) explained by change in arousal ($\triangle$ARS).

The impact of arousal increases on performance would depend on where the swimmers were on the arousal-performance curve during the regular season. An implicit assumption for this study was that the swimmers were near their optimum level of arousal during the regular season. Given the above assumption, a large increase in incentive and, subsequently, arousal would be expected to precipitate a decrease in performance, as would a large decrease in incentive and arousal. Few of the swimmers, however, were expected to experience a decrease in incentive or arousal because the championship was expected to be more motivating and arousing than the regular season. Therefore, increases in incentive and arousal from the regular season to the championship were expected, and the magnitude of those <u>increases</u> was

expected to be related to the magnitude of performance impairment. For the few swimmers whose incentive and arousal decreased from the regular season to the championship, the magnitude of the decreases were expected to be related to the magnitude of performance impairment.

E. Analyses

For each swimmer in this study, three change scores were determined: change in incentive, change in arousal, and change in performance. The analysis of raw change scores has been questioned by Lord (1963), Cronbach and Furby (1970), Linn and Slinde (1977), Johns (1981), and others. Several different techniques have been suggested for analyzing relationships between change scores and other variables. One technique proposed by Lord and Novick (1968, p. 76) was to correct the correlation between a raw change score and another variable for attenuation. Cronbach and Furby (1970) and Linn and Slinde (1977) suggested using a partial correlation between the other variable and the final component of the change score variable, with the initial component of the change score variable partialed out. They also claimed that the partial correlation should be corrected for attenuation. This study presented a unusual situation in that the relationship between two change scores was investigated. Therefore, when using partial correlations, the initial components of both change scores were partialed out when following Cronbach and Furby (1970) and Linn and Slinde's (1977) advice.

Kenny (1975, p. 359) suggested the use of multiple methods when analyzing change scores. In this way, convergence of results bolsters confidence in the findings. Kenny's advice was followed in this study. Four methods were employed to examine each hypothesized relationship between change scores. These four methods were as follows:

1. A partial correlation between the final component scores of the change scores was computed while partialing out the effects of the initial component scores of the change scores.

2. The partial correlation described above was computed, but only after having corrected the partial correlation for attenuation due to the unreliability of the initial and final component scores used in the analysis.

3. A Pearson correlation between raw change scores was computed.

4. The Pearson correlation between the raw change scores previously described was corrected for attenuation due to the unreliability of the change scores used in the analysis. The reliability of the change scores was estimated using Lord and Novick's (1968, p. 76) equation for the reliability of a change score:

r change =

$$\frac{(r22 * \sigma^2 2) + (r11 * \sigma^2 1) - (2 * r12 * \sigma 1 * \sigma 2)}{\sigma^2 (2\text{-}1)} \qquad (1)$$

where:

r11 = the reliability of the initial component

r22 = the reliability of the final component

r12 = the correlation between the two components

$\sigma 1$ = the standard deviation of the initial component

σ 2 = the standard deviation of the final component

σ (2-1) = the standard deviation of the change score

These four methods were used to analyze the linear relationships specified in the four hypotheses. The second, third, and fourth hypotheses included curvilinear relationships as well as linear relationships. One weakness of both partial correlations and Lord and Novick's method of correcting correlations with change scores for attenuation is that they are not amenable to the examination of curvilinear relationships. Therefore, it was necessary to employ raw change scores when analyzing the curvilinear relationships. To analyze the curvilinear relationships in the second and third hypotheses, the following F test (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975, p. 372) was used:

$$F = \frac{(R^2\ y.12) - (R^2\ y.1)}{(1 - R^2\ y.12) / (N - k - 1)} \qquad (2)$$

where:

y = $\triangle$Performance

1 = $\triangle$ARS (hypothesis two) or $\triangle$INC (hypothesis three)

2 = $\triangle$ARS^2 (hypothesis two) or $\triangle$INC^2 (hypothesis three)

N = sample size

k = total # of independent variables

The degrees of freedom for F are 2 and (N - k - 1).

To evaluate the fourth hypothesis the following F test (Nie et al., 1975, p. 339) was used:

$$F = \frac{(R^2_{y.123}) - (R^2_{y.12}) \;/\; M}{(1 - R^2_{y.123}) \;/\; (N - k - 1)} \qquad (3)$$

where:

y = $\triangle$Performance

1 = $\triangle$ARS

2 = $\triangle$ARS^2

3 = $\triangle$INC

N = sample size

M = # of independent variables in the incentive subset

k = total # of independent variables

The degrees of freedom for F are 2 and (N - k - 1)

F. Power Analysis

According to Cohen (1977, p. 1), "the power of a statistical test is the probability that it will yield significant results." And this probability subtracted from one equals the probability that a Type II error will be committed (the test fails to uncover a true effect).

A power analysis was conducted to determine the statistical power for the four analyses in the preceeding section, given the number of subjects available. Analysis number four has less power than the

other three analyses because it has more independent variables. Therefore, the results of the following power analysis on analysis number four was be used as a conservative estimate of the power of the first three analyses.

Analysis number four would be, according to Cohen (1977, p. 409), a Case 1 Multiple Regression example, where "the proportion of Y variance accounted for by a set B, over and above what is accounted for by another set A, is determined." Three variables are needed to determine the power for this kind of statistical test: alpha level, the number of independent variables in "set B", and L.

L is determined by multiplying f^2 and the denominator of the error term (N - k - 1). For a small effect size, f^2 would be .02, and for a medium effect size, f^2 would be .15. Thus, for a small effect, L would be .02 multiplied by 95, or 1.9, and for a medium effect, L would be .15 multiplied by 95, or 14.25. Set B was comprised of one independent variables, $\triangle$INC. The alpha level is .05.

Using Cohen's (1977, p. 417) Table 9.3.2, the power of analysis number four for a small sized effect would be approximately .20, and the power of analysis number four for a medium sized effect would be approximately .93. Thus, this study is not likely to uncover a small effect, but it is likely to uncover a medium sized effect, if one exists.

G. Exploratory Analyses

A number of exploratory tests were also carried out in hope of providing further insight into the nature of the motivation-arousal-performance relationship. Specifically, the role of effort-performance expectancy in the motivation-arousal-performance relationship was investigated. Also, the gender, age, and number of years of experience of the swimmers were examined for their effects on the motivation-arousal-performance relationship. Finally, trait anxiety was examined to see whether trait anxious individuals experienced more arousal and poorer performance than their low trait anxious counterparts.

CHAPTER IV

RESULTS

The purpose for this chapter is to describe the evidence for the central thesis that the performance of a well learned, complex task can be impaired if incentives are too high, and whether the negative influence of strong incentives on performance might be mediated by arousal, as hypothesized. The evidence has been organized into the following six sections: (a) the development and assessment of operational measures, (b) assumptions regarding experimental conditions, (c) findings regarding experimental conditions, (d) issues regarding the analysis of change scores, (e) testing the four main hypotheses, and (f) exploratory findings.

A. Development and Assessment of Operational Measures

Three major variables were used in this study: social and self-mastery incentive (hereafter referred to as incentive), arousal, and performance. These three variables were measured twice for each subject, once during a regular season meet and once during a championship meet. In order to examine the proposed model of the relationships between incentive, arousal, and performance within-subject, it was necessary to measure the subjects' change in each of the three variables across the two settings, regular season

and championship. In doing so, three new variables were created: change in social and self-mastery incentive, change in arousal, and change in performance. The focus of this section will be to explain how each variable was operationalized and to assess the effectiveness of each measure.

The descriptive statistics for incentive, arousal, and performance are reported in Table IV-1. The subjects' regular season incentive, arousal, and performance are labelled Incentive 1, Arousal 1, and Performance 1, while the subjects' championship incentive, arousal, and performance are labelled Incentive 2, Arousal 2, and Performance 2. The change scores for incentive, arousal, and performance were obtained by subtracting each subject's regular season score from his or her championship score. For example, Change in Incentive was derived by subtracting Incentive 1 from Incentive 2. The incentive measures - Incentive 1, Incentive 2, and Change in Incentive - will be examined first, followed by the arousal measures, and finally by the performance measures.

Incentive and Change in Incentive

Because an expectancy theory perspective was used to operationalize motivation in this study, two types of scores were used to determine Incentive 1 and Incentive 2: the valence of outcomes associated with swimming well or not swimming well and the subjective probability of obtaining those outcomes following a good or a bad performance, the

Table IV-1

Descriptive Statistics of Incentive, Arousal, and Performance

Variable	n	mean	std. dev.	reliabilty	skewness	kurtosis
Incentive 1 (regular season)	102	2670.8	831.65	.82 a	-.10	-.10
Incentive 2 (championship)	98	2880.0	956.98	.86 a	-.05	.60
Change in Incentive	92	267.46	623.45	.41 c	.15	.59
Practice Arousal	55	38.58	8.89	.86 a	.02	.31
Arousal 1 (regular season)	105	44.67	9.19	.88 a	.09	.20
Arousal 2 (championship)	99	45.84	9.24	.87 a	.16	.14
Change in Arousal	98	1.02	10.29	.77 c	.13	-.22
Performance 1 (regular season)	109	587.64	63.46	.84 b	-.09	-.35
Performance 2 (championship)	103	632.51	70.57	.79 b	-1.22	4.45
Change in Performance	103	38.02	66.83	.69 c	-.95	6.55

a - reliability determined by coefficient alpha.
b - reliability determined by test-retest.
c - reliability determined by Lord and Novik's (1968, p. 76) equation for the reliability of a change score.

performance-outcome expectancy. Incentive was operationalized as the product of the valence of an outcome multiplied by the performance-outcome expectancy, summed across all outcomes.

A pilot study was conducted to test this instrument. The results of the pilot study are reported in Appendix A. Briefly, two of the original twenty items were eliminated because they did not significantly correlate with the total incentive score. Cronbach's alpha was used to estimate the reliability of incentive in the pilot study. For the regular season, an alpha coefficient of .77 was obtained. For the championship, an alpha coefficient of .88 was obtained. It was decided that because the instrument was internally consistent and had at least face validity as a measure of social and self-mastery incentive, it would be used to measure incentive in the larger study.

After undergoing the above refinements, the incentive instrument was used in this study to measure each subject's regular season and championship incentive (Incentive 1 and Incentive 2, respectively). The descriptive statistics for Incentive 1 and Incentive 2 are reported in Table IV-1 as well as the estimated reliabilities. The measures were reasonably reliable, as estimated by Cronbach's alpha, with an alpha coefficient of .82 for Incentive 1 and .86 for Incentive 2. The descriptive statistics for Change in Incentive are also reported in Table IV-1. Change in Incentive was less reliable, with an estimated reliability of .41. This coefficient was obtained by using

Lord and Novick's (1968, p. 76) equation for estimating the reliability of a change score.

Arousal and Change in Arousal

Arousal was measured with the State section (SAI) of the State-Trait Anxiety Inventory (STAI). The SAI was chosen as an operational definition of arousal for four reasons: (1) according to Martens (1977, p. 5), "state anxiety as defined is closely associated with the concept of arousal," (2) as stated in the Literature Review, there are several advantages to measuring arousal with a self report instrument such as the SAI, (3) the SAI has been used as a measure of arousal in many other studies, especially in the sports psychology literature, and (4) several of the items on the SAI appear to measure arousal as much as anxiety (e.g., "I was jittery," "I felt 'high strung'," etc.)

The SAI has undergone extensive development and testing (Katkin, 1978). The results of these studies are summarized in Appendix B. In general, the SAI has low test-retest reliability due to its transitory nature, but high internal consistency. Spielberger et al., (1970) reported alpha coefficients ranging from .83 to .92, with higher coefficients obtained under stressful conditions.

It was decided to use the SAI to measure arousal in this study. The descriptive statistics are reported in Table IV-1. An alpha

coefficient of .88 was obtained for arousal during the regular season (Arousal 1) and an alpha coefficient of .87 was obtained for arousal during the championship (Arousal 2). These values are consistent with previous research. Change in Arousal was also fairly reliable. Using Lord and Novick's (1968, p. 76) equation for estimating the reliability of a change score, Change in Arousal reliability was estimated to be .77. The SAI was apparently a reliable and effective measure of arousal.

Some of the subjects also completed the SAI before a swim practice. This score was not used in determining the Change in Arousal scores. It was measured to assess differences in practice arousal levels from competition arousal levels. The descriptive statistics for this measure (labelled Practice Arousal) are reported in Table IV-1. It should be noted that the level of arousal assessed during practice was substantially lower than the level of arousal assessed during competition, as would be expected.

Performance and Change in Performance

Performance was operationally defined as the time it took the subjects to swim their best event. The subjects selected what they felt to be their best event prior to the competitions. Unlike the hypothetical constructs of incentive and arousal, performance does not have to be inferred from an individual's behavior,and thus, stands by itself as a valid measure.

As mentioned in the Methodology chapter, performance was standardized acccording to the subjects' event and gender so that comparisons could be made between different events and males and females. As reported in Table IV-1, performance during the championship (Performance 2) is greater than performance during the regular season (Performance 1). In terms of swim times, this means that the Performance 2 times were faster than the Performance 1 times, on average.

By obtaining the swim results of several regular season and championship meets during the same season, it was possible to compute test-retest reliabilities for regular season and championship performance (as opposed to the reliability of the measure of performance). The estimated reliability of Performance 1 was .84. The estimated reliability of Performance 2 was .79. Lord and Novick's (1968, p. 76) equation for the reliabilty of a change score was used to estimate the reliability of Change in Performance. A coefficient of .69 was obtained. Swim times appear to be a reliable and effective measure of performance.

In conclusion, the measures of incentive, arousal, and performance for the regular season and for the championship used in the present study were found to be reasonably reliable, with estimated reliabilities ranging from .79 to .88. While the change measures were less reliable, Change in Arousal and Change in Performance were still fairly reliable with estimated reliability coefficients of .77 and

.69, respectively. Change in Incentive, on the other hand, was fairly unreliable, and any conclusions based on this measure must, therefore, be considered accordingly.

B. Assumptions Regarding Experimental Conditions

There were two naturally occurring experimental conditions in this study, regular season competition and championship competition. The major hypotheses being investigated in this study were predicated on two assumptions regarding the swimmers' level of arousal during these two experimental conditions. The first assumption was that the swimmers were near their optimum level of arousal during the regular season. The second assumption was that the swimmers were overaroused during the championship. In this section, the results that would be expected to occur if these two assumptions are true will be delineated.

The hypothetical relationship between arousal and performance is in the shape of an inverted U. The optimum arousal level is at the top point of the inverted U, such that for that level of arousal performance is expected to be maximized. Figure IV-1 (A) depicts the scattergram that would be expected if the swimmers in this study were tightly grouped near their optimum arousal level during the regular season, as stated in the first assumption.

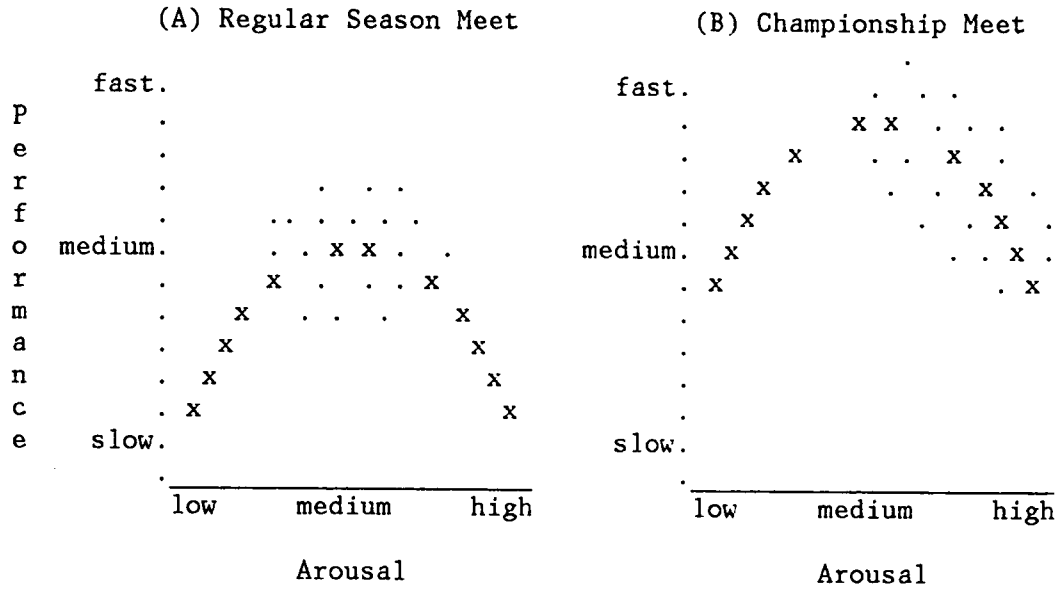


Figure IV-1. Scatterplots representing the assumed relationships between arousal and performance for the regular season and the championship.

The second assumption, that the swimmers were overaroused during the championship, is based on the following line of thought. To begin with, swimmers who experience an increase in incentive are expected to experience a subsequent increase in arousal. Because the swimmers' level of incentive is expected to increase from the regular season to the championship, the swimmers' level of arousal is expected to increase along with incentive. If the first assumption is true and the swimmers were at their optimum arousal level during the regular season, and if the swimmers' arousal level was higher during the championship, then the swimmers would be expected to move past their regular season optimum arousal level, depicted in the scatterplot in Figure IV-1 (A), to a state of overarousal during the championship, depicted in the scatterplot in Figure IV-1 (B).

The above discussion suggests an increase in arousal and incentive from the regular season to the championship, and a subsequent decrease in performance during the championship due to the effects of overarousal. However, while arousal and incentive are expected to increase during the championship, special championship training methods are also expected to increase performance during the championship in spite of the damaging effects of overarousal which the championship is expected to bring on. One of the special training methods used by the swimmers to maximize championship performance was to taper down their workout loads as the championship approached to marshall their strength. They also shaved before the championship meet to reduce drag in the water. To explain how the swimmers could be

more aroused yet perform better, it is helpful to refer to Figure IV-1 again. In graph A, the swimmers are at a "medium" arousal level and a "medium" performance level for the regular season, on average. In graph B, the swimmers are at an arousal level between "medium" and "high" and they are at a performance level between "medium" and "fast" for the championship, on average. Because of the swimmers' special training methods for the championship, performance is expected to be greater for the championship than for the regular season, on average, in spite of greater arousal, on average, for the championship.

The expected relationships listed below would lend support to the assumptions of regular season optimum arousal and championship overarousal.

1. Arousal will be greater during the regular season than during practice.
2. Arousal will be greater during the championship than during the regular season.
3. There will be no relationship between arousal and performance for the regular season.
4. There will be a negative linear relationship between arousal and performance for the championship.

C. Findings Regarding Experimental Conditions

As stated previously, there were two naturally occurring experimental conditions in this study, regular season competition and championship competition. Incentive was expected to be greater during

the championship condition than during the regular seaon condition, and this expectation was realized ($t=4.11$, $p<.05$), as reported in Table IV-2.

Because of the presumed relationship between incentive and arousal, arousal was expected to increase along with incentive. This, however, did not occur ($t=.98$, $p>.05$), as reported in Table IV-2. Because arousal was expected to increase from the regular season to the championship, championship arousal was expected to be negatively related to championship performance. This relationship also failed to materialize ($r=-.20$, $p>.05$), as reported in Table IV-3.

Only two of the four expected relationships that would have lent support to the assumptions of regular season optimum arousal and championship overarousal were found. As reported in Table IV-3, regular season arousal was significantly greater than practice arousal ($t=3.69$, $p<.05$), indicating that the swimmers were, on average, further along the arousal curve during the regular season than during practice. Also, as reported in Table IV-2, a nonsignificant relationship between regular season arousal and championship arousal ($r=-.19$, $p>.05$) was found. However, as mentioned, championship arousal was not significantly greater than regular season arousal, and championship arousal was not significantly related to championship performance.

Table IV-2

T-Tests for Differences in Regular Season and Championship Incentive, Arousal, and Performance

Variable	Mean	Variable	Mean	t
Incentive 1	2670.83	Incentive 2	2880.00	4.11 *
Practice Arousal	38.58	Arousal 1	44.67	3.69 *
Practice Arousal	38.58	Arousal 2	45.84	4.89 *
Arousal 1	44.67	Arousal 2	45.84	.98
Performance 1	587.64	Performance 2	632.51	5.77 *

* $p < .001$

Table IV-3

Correlation Matrix of Regular Season and Championship Incentive, Arousal, and Performance

	1.	2.	3.	4.	5.
1. Incentive 1	---				
2. Incentive 2	.75 *	---			
3. Arousal 1	.00	-.02	---		
4. Arousal 2	-.10	.11	.39 *	---	
5. Performance 1	-.10	-.04	-.19	-.10	---
6. Performance 2	.08	-.05	.00	-.20	.48 *

* $p < .05$

One explanation for the nonsignificant relationship between arousal and performance during both the regular season and the championship would be that the swimmers were near their optimal level of arousal during both meets. An alternative explanation for the nonsignificant relationship would be that there were large individual differences in the swimmers' arousal levels, some being underaroused, some being optimally aroused, and some being overaroused. Even if there were large individual differences in the swimmers' arousal levels during the regular season, a significant increase in arousal from the regular season to the championship might still lead to a negative relationship between championship arousal and championship performance, in other words, the swimmers would be, on average, overaroused during the championship. But this scenerio was not supported. There was no experimental (regular season and championship competition) main effect for arousal, and championship arousal was not related to championship performance. The remainder of this section will deal with the implications of these findings for the major hypotheses of this study. It will be argued that although the assumptions underlying this study were not fully supported, the major hypotheses are still tenable.

The Swimmers' Position on the Arousal-Performance Curve

As suggested in the preceding section and as reported in Table IV-2, both incentive and performance increased on average from the regular season to the championship. The increase in incentive was supposed to lead to an increase in arousal, but as mentioned earlier,

arousal did not increase from the regular season to the championship. Apparently, the swimmers, on average, remained at the same point on the arousal-performance curve for both the regular season and the championship. The correlations between arousal and performance were -.19 ($p>.05$) for the regular season and -.20 ($p>.05$) for the championship. The means for arousal were 44.67 for the regular season and 45.84 for the championship. The similarity of these means and correlations for both the regular season and the championship suggests that the swimmers were at similar points on the arousal-performance curve. Furthermore, the evidence seems to indicate that the swimmers were at a point of slight overarousal on the arousal-performance curve. The relationships between arousal and performance for the regular season and the championship, although not significant at the conventional .05 level, were significant at .056 and .053, respectively. Both of these relationships were negative, and the likelihood of relationships of that magnitude occurring by chance is less than .06. Because the relationships are not significant, it cannot be said that the swimmers were <u>fully</u> overaroused. However, given the relative strength of both negative relationships, their consistency with the mean arousal levels, and what is known about the hypothetical relationship between arousal and performance, it seems reasonable to state that the swimmers were <u>slightly</u> overaroused, for both the regular season and the championship.

Implications for the Major Hypotheses

The first major hypothesis, that change in arousal will be a positive linear function of change in incentive, does not depend on the swimmers' position on the arousal-performance curve. However, the second major hypothesis, that change in performance will be a negative linear function of change in arousal, was based on the assumptions that arousal would be at an optimum level during the regular season, but would be at a level of overarousal during the championship.

To explain the negative relationship expected between change in arousal and change in performance, it will be helpful to consider first the swimmers with a small change in arousal. If the swimmers were at their assumed optimum level of arousal during the regular season, then the swimmers who maintained a similar arousal level during the championship (i.e., experienced a small change in arousal) would be expected to be at their optimum level of arousal during the championship as well. Because the swimmers' performances are expected to improve during the championship due to special championship training methods, the swimmers with small arousal changes would be expected to experience the greatest performance gains.

Those swimmers who experienced large gains in arousal from the regular season to the championship would be expected to move from a point of optimum arousal during the regular season to a point of overarousal during the championship. Because of the overarousing

condition of the championship situation for those swimmers with large arousal gains, they would not be able to benefit as much as the swimmers with small arousal changes from the special championship training methods. In other words, large arousal gains would be expected to related to small performance changes, while small arousal changes would be expected to be related to large performance gains. That is to say, a negative relationship would be expected between change in arousal and change in performance, if the assumptions of optimum arousal level during the regular season and overarousal during the championship held true.

However, those two assumptions did not hold true. The swimmers were apparently slightly overaroused during the regular season and the championship. Given that this interpretation of the swimmers being slightly overaroused is an accurate one, a negative relationship between change in arousal and change in performance would still be expected. To explain why, it would be helpful to start with the swimmers who experienced an increase in arousal from the regular season to the championship. Because these swimmers are already slightly overaroused, on average, during the regular season, increases in arousal during the championship could lead to high levels of overarousal, and subsequently, precipitous drops in performance. In other words, the swimmers with the largest gains in arousal would be expected to experience the greatest performance impairment.

Decreases in arousal from the regular season to the championship would be expected to lead to different outcomes depending on where the swimmers were on the arousal-performance curve during the regular season. For example, a decrease in arousal during the championship would be expected to improve the performance of swimmers who were overaroused during the regular season, and would be expected to impair the performance of swimmers who were at their optimum arousal level during the regular season. If the swimmers, therefore, were slightly overaroused initially, with an approximately equal number of swimmers decreasing and increasing their levels of arousal during the championship, then a negative relationship with a curvilinear component would be expected between change in arousal and change in performance. Figure IV-2 depicts the shape of the expected relationship between change in arousal and change in performance. Because the swimmers were presumably initially slightly overaroused during the regular season, increases in arousal are expected to lead to steeper drops in performance than decreases in arousal because decreases in arousal are expected to be beneficial, up to a point.

The negative, nonlinear (in the shape of an inverted U) relationship expected between change in arousal and change in performance is based on two assumptions, (1) that the swimmers were slightly overaroused, on average, during the regular season and (2) that the swimmers were also slightly overaroused, on average, during the championship. The support for these assumptions came from (1) the strength of the relationships between regular season arousal and

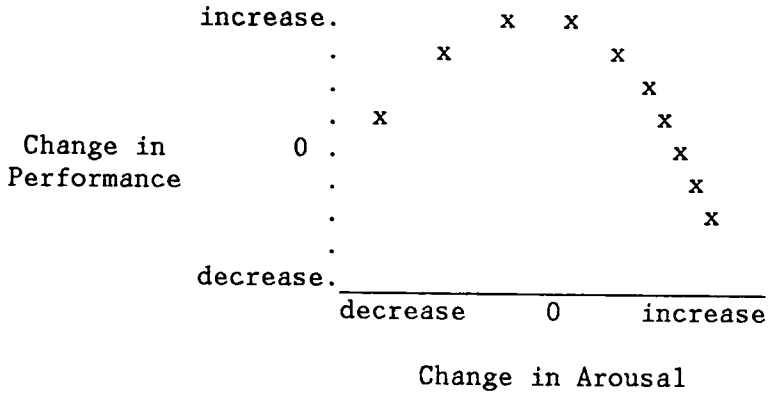


Figure IV-2. Predicted relationship between change in arousal and change in performance.

regular season performance (r=-.19, p=.56) and championship arousal and championship performance (r=-.20, p=.53), (2) the significant increase in arousal, on average, from practice to the regular season (t=3.69, p<.05) and from practice to the championship (t=4.89, p<.05), and (3) the curvilinear nature of the arousal-performance relationship. The latter a nonsignificant relationship may have been due to many of the swimmers being optimally aroused. It must be noted, however, that the negative relationships between arousal and performance were nonsignificant at the conventional .05 alpha level. Therefore, the conventional interpretation of either result considered alone would be that arousal is not related to performance. Thus, the interpretation that the swimmers were slightly overaroused must be made with great caution, as must subsequent conclusions based on this assumption.

D. Issues Regarding the Analysis of Change Scores

As mentioned previously, change scores were computed so that the change in the swimmers' incentive, arousal, and performance could be analyzed within-subject. However, the use of raw change scores has been questioned by Lord (1963), Cronbach and Furby (1970), Linn and Slinde (1977), Johns (1981), and others. In this section, the problems of using change scores will be presented along with suggested alternative methods of data analysis. The researchers who have studied this issue of the analysis of change scores usually refer to these scores as "difference scores", with "change" being one example of a

difference score. Therefore, the more general term, "difference score", will be used for the remainder of this section instead of the more specific "change score".

Problems

Johns (1981, p. 447) listed three basic technical problems of difference scores: potential unreliability, systematic correlation with their components, and spurious correlation with other variables. Another problem mentioned by Johns was the questionable meaning of difference scores. These four problems will be examined in the following paragraghs.

Potential unreliability: Lord (1963), Cronbach and Furby (1970), Linn and Slinde (1977), and Johns (1981) all agree that difference scores have a strong potential for unreliability. Their reasoning is based on (1) the classical formula for the reliability of a difference score and (2) the tendency for the two component measures of a difference score to be positively related.

The classical formula for the reliability of a difference score is:

$$r_{difference} = \frac{(r11 * \sigma_1^2) + (r22 * \sigma_2^2) - (2 * r12 * \sigma_1 * \sigma_2)}{\sigma_1^2 + \sigma_2^2 - (2 * r12 * \sigma_1 * \sigma_2)} \quad (4)$$

where:

r11 = the reliability of the initial component

r22 = the reliability of the final component

r12 = the correlation between the two components

σ_1 = the standard deviation of the initial component

σ_2 = the standard deviation of the final component

As indicated by Johns (1981):

> Inspection indicates that the reliability of a difference score will equal the average reliability of its component parts only when the correlation between these components is zero. In the likely event of a positive correlation between components, the reliability of a difference score will be attenuated. In the unlikely event of a negative correlation, the reliability of a difference score will be magnified. (p.448)

While reliable difference scores could be obtained by component measures that correlated poorly or negatively, Linn and Slinde (1977, p. 123) commented that such a situation would make one question whether the two components are measuring the same construct. If the same scale is used at two points in time to determine the two

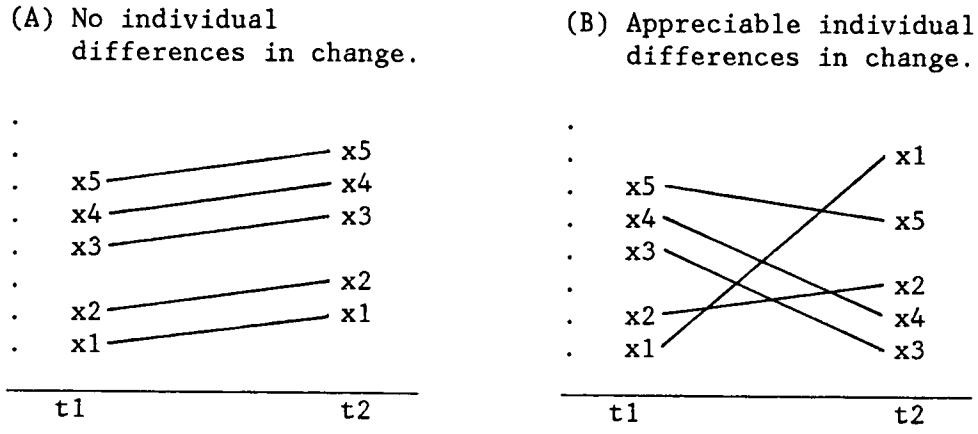
components of a difference score, the two components will more than likely correlate positively. Furthermore, when the two components are provided by the same person, the components are likely to be positively correlated. Johns (1981, p. 448) explained, "When a single individual provides both components of a difference score, the components contain common variance which is a function of the rater's general response style."

In this study, change scores were derived from a single individual being measured by the same scale at two points in time. Therefore, a positive correlation between the component measures was expected, with a subsequent reduction in change score reliability. As reported in Table IV-3, the component measures were positively correlated: .75 ($p<.05$) for incentive, .39 ($p<.05$) for arousal, and .48 ($p<.05$) for performance. And as reported in Table IV-1, change score reliabilities were lower than component score reliabilities for incentive, arousal, and performance. However, the measures used in this study, especially incentive and arousal, measured transitory states as opposed to stable traits. Therefore, the correlation between the component measures was not expected to be strongly correlated, thus reasonably reliable change scores were expected.

The reduction of a difference score's reliability due to the positive correlation between a difference score's components may be overstated. Rogosa, Braudt, and Zimowski (1982, p. 734) explained that it is only when the correlation between the components is very large

that the reliability of the difference score is appreciably reduced. As an example, they pointed out that when the components' reliabilities are .90 and the correlation between the components is .50, the reliability of the difference score will be 91% of the component's reliability. According to Rogosa et al., (1982, p. 733), the important question is the variability of the individuals' differences, for both the correlation between the components and the difference score reliability depend on the variability of the individuals' differences. If the components are reliable and there are individual differences to be detected, the reliability of the difference score "will be respectable."

The reliability of a difference score will be zero if there are no individual differences in true change, regardless of how precisely each individual's change is measured. This situation is depicted in graph A of Figure IV-3. However, as individual differences in true change increase, as in graph B of Figure IV-3, the reliability of the difference score will also increase (Rogosa et al., 1982, p. 731). The variables used in this study were expected to have a fair amount of individual difference in true change. The performance variable for example was expected to have a fair amount of variation in individual change because the coaches of the swimmers had expressed their dismay about how some swimmers swam their best during championships, while other swimmers swam their worst during championships. The swimmers were also expected to experience different changes in arousal and



t1 = The true score at time one.
t2 = The true score at time two.

Figure IV-3. Variations in individual differences in true change.

Adapted from "A Growth Curve Approach to the Measurement of Change" by David Rogosa, David Braudt, and Michele Zimowski, 1982, Psychological Bulletin, 92, p. 731.

incentive, some experiencing large gains and others experiencing small gains or even losses.

In spite of Rogosa et al.'s observation that difference score reliabilities will be respectable when the component measures are reliable and not too strongly correlated, many psychologists, such as Linn and Slinde (1977), still question whether the component measures not strongly correlated are measuring the same construct. Furthermore, Rogosa et al. (1982) did not recommend the use of difference scores, but suggested that it would be much more useful to measure individuals at several points in time, not just two, when measuring individual change. Nonetheless, they stated that "two waves of data are better than one" (p. 729), that "difference scores are not intrinsically unreliable" (p. 730), that "the difference score can be an accurate and useful measure of individual change even in situations where the reliability is low" (p. 730), that "the difference score is an unbiased estimate of true change" (p. 730), and that, "to discard the logic of models for individual change because of the deficiencies of two-wave data is like 'throwing the baby out with the bathwater'" (p. 735).

Johns (1981, p. 449) mentioned an additional threat to the reliability of difference scores, unreliable component scores. Component scores which consist of a single item or heterogeneous items are likely to be unreliable. The component measures used in this study, however, have been shown to be reasonably reliable.

Systematic and spurious associations: There is a tendency for difference scores to be systematically correlated with their components (Johns, 1981, p. 451). Specifically, the initial component typically correlates negatively with the difference score (Lord, 1963; Cronbach & Furby, 1970; Linn & Slinde, 1977; Johns, 1981). This occurs because those individuals who score near the extremes on measures that are not perfectly reliable tend to regress toward the mean when measured a second time. When people are measured on two occasions, the initial score will tend to be a negative predictor of the difference score, because low initial scores will be associated with gains (in regressing toward the mean, individuals with low initial scores will tend to have higher final scores, and thus, a gain from the initial score to the final score), while high initial scores will be associated with losses.

This systematic correlation between a difference score and its components can be a problem when one is interested not so much in each individual's difference score but in how the difference score correlates with other, outside variables. Outside variables which are related to the components of the difference score are likely to be related to the difference score as well. The correlations between the outside variables and the difference score are, in Johns' (1981, p. 451) words, "clearly methodological artifacts due to the confounding of difference scores with their components."

In the case of this study, one of the goals was to uncover those variables which were related to arousal change. One of the variables which was strongly related to the arousal change components (Arousal 1 and Arousal 2) was trait anxiety ($r=.49$, $p<.05$; $r=.40$, $p<.05$; respectively), as measured by the trait section of the State-Trait Anxiety Inventory. One would expect high trait anxious individuals to experience a greater increase in arousal from the regular season to the championship than low trait anxious individuals because the championship is more ego threatening. In other words, one would expect a positive correlation between trait anxiety and arousal change. However, the correlation between trait anxiety and arousal change was not positive but was negative ($r=-.13$, $p>.05$). This was because individuals with high trait anxiety scores tended to have high initial arousal scores which tended to regress downward toward the mean. Thus, high trait anxiety was spuriously related to decreases in arousal, instead of increases as expected.

Questionable meaning: According to Johns (1981, p. 453), researchers often attach an arbitrary label to a difference score. The label is supposed to represent some construct, but the researchers often fail to provide independent evidence that the difference score does indeed capture that construct. They also often fail to provide a theoretical explanation of how the difference measure is an adequate measure of the construct they want to measure.

One solution to the problem of the questionable meaning of a difference score was to ground the difference score soundly in theory (Johns, 1981). The use of difference scores in this study was not decided in an arbitrary or haphazard manner. The motivation for the use of difference scores arose from the need to examine change, how changes in motivation influenced changes in the performance of a complex task. Campbell and Pritchard (1976), in pointing out the shortcomings of past expectancy theory of motivation research, stressed (1) the need for longitudinal studies as opposed to studies at a single point in time and (2) the need for within-subject analysis as opposed to between-subject analysis. Because expectancy theory is frequently viewed as a within-subject theory of motivation, it is more useful to investigate how an individual's behavior changes in relation to changes in his or her motivation, as opposed to investigating how individuals with different levels of motivation differ in their behavior. Thus, the decision to use change scores was based on theoretical grounds.

Conclusions: Cronbach and Furby (1970, p. 68) argued that difference scores, "are rarely useful, no matter how they may be adjusted or refined." Johns (1981) reiterated this argument:

> It is difficult to advocate the continuation of the use of difference scores in which both components are provided by the same individual. In general, such scores seem especially prone to unreliability and spurious associations, while lacking significant utility. (p. 458)

In spite of the many complaints against the use of difference scores, some researchers (Kenny, 1975; Cook & Campbell, 1979; Rogosa et al., 1982) do not completely dismiss the use of difference scores. Rogosa et al. (1982, p. 735) for example, argued that, "the often cited deficiencies of the difference score - low reliability and negative correlation with initial status - are more illusory than real." Although Rogosa et al. did not completely dismiss the use of difference scores, they also did not advocate their use. In fact, one of the central points of their article was that, ideally, more than two observations of each subject should be made when measuring change. The purpose of this study is not to resolve the issue of whether or not difference scores should be used. However, since the use of difference scores was integral to the present study, it was felt that, in light of the many arguments against the use of difference scores, there was a need to justify their use. The complaints against their use include: potential unreliability, systematic correlation with their components, and therefore, spurious correlation with other variables, and the questionable meaning of difference scores.

In response to the last complaint concerning questionable meaning, the decision to study change in incentive, arousal, and performance, instead of incentive, arousal, and performance at one point in time, was based on theoretical grounds, as explained earlier. Further, in developing these change instruments, an effort was made to insure that the component measures would be as reliable and as valid as possible, in line with Johns's (1981) advise:

> It is impossible to conceive of a theoretically relevant difference score whose components are theoretically irrelevant. Therefore, potential components should be carefully justified by theory and rigorously measured, analyzed, and reported, whether or not differences are ultimately employed. Potential components should consist of internally consistent multiple-item scales, not heterogeneous collections of factorially indeterminant items. (p. 459)

The results of these efforts were presented in the first section of this chapter.

In regards to the other two problems - potential unreliability and systematic correlation with their components, and therefore, spurious correlation with other variables - Rogosa et al. (1982) argued that to discard the use of difference scores due to their deficiencies was to "throw the baby out with the bathwater". However, they also stated that, although two data points are better than one, there remain many problems with the use of difference scores. While the decision by certain researchers to condemn the use of difference scores in all situations may be premature, in pointing out the weaknesses of using difference scores, these researchers have come up with many useful suggestions for the analysis of difference scores. Among these suggestions are alternative methods of analysis which correct for the problems of potential unreliability and systematic correlation with their components, and therefore, spurious correlation with other variables. In the following paragraghs, these alternative methods will be discussed.

Alternative Methods

-The main concern of the alternative methods to be discussed is how to measure the relationships between difference scores and other variables in light of the two problems of (1) the potential unreliability of difference scores and (2) spurious correlations between difference scores and other variables due to the systematic association between a difference score and its components. The first method, correction for attenuation, deals with the first problem, unreliability. The second method, partial correlation, deals with the second problem, spurious correlations. The consensus of opinion is that both methods should be employed simultaneously (Lord, 1963; Linn & Slinde, 1977; Johns, 1981). In other words, one should use partial correlations that have been corrected for attenuation.

Correction for attenuation: Unreliability attenuates all observed correlations. Since difference scores are especially prone to unreliability, correlations involving difference scores tend to be low. When one is correlating one difference score with another, as is done in this study, the potential for obtaining nonsignificant correlations is even higher.

A method was suggested by Lord and Novick (1968, p. 76) for determining the correlation between a difference score and some other, outside variable, which corrects the problem of the correlation being attenuated due to the unreliability of the difference score. The

method is to first correlate the raw observed difference scores with the outside variable. This correlation should then be corrected for attenuation due to the unreliability of the difference score. This produces the hypothetical relationship between the outside variable and a perfectly reliable difference score, thus overcoming the problem of an unreliable difference score.

Partial correlation: While the above method corrects for the problem of low difference score reliability, partial correlation has been suggested (Lord, 1963; Cronbach & Furby, 1970; Linn & Slinde, 1977) as a way to correct for spurious correlations between difference scores and other variables due to the systematic association between a difference score and its components. In this method, the initial component score is partialed out of the relationship between the final component score and some other, outside variable. The result is the expected relationship between the final component score and the other, outside variable for individuals with the same initial component score.

An example of a spurious correlation mentioned previously was the relationship between change in arousal and trait anxiety. Because trait anxiety was related to initial arousal ($r=.49$, $p<.05$), it was negatively related to change in arousal ($r=-.13$, $p>05$). Partial correlation analysis between final arousal and trait anxiety with initial arousal partialed out (and corrected for attenuation) produced a different result ($r=.23$, $p>.05$). The point of this example is to

show that results obtained from raw change scores can differ a great deal from results obtained from partial correlation. Which result is of more utility depends on the question being asked.

All of the authors who recommend the use of partial correlation in place of the use of difference scores (Lord, 1963; Linn & Slinde, 1977; Johns, 1981) also recommend that the partial correlations should be corrected for attenuation due to the unreliability of the initial component score, or whatever variable is being partialled out of the relationship. The effect of correcting the partial correlation for attenuation due to the unreliability of the final component score and/or the unreliability of the other, outside variable would be to increase the magnitude of the partial correlation, but it would not change the sign of the partial correlation. However, correcting the initial component score for attenuation could change the sign of the partial correlation. By correcting the partial correlation for attenuation in the method described above, the problems of the potential unreliability of difference scores and spurious correlations between difference scores and other variables due to the systematic association between a difference score and its components are effectively bypassed.

In conclusion, the problems inherit in the use of difference scores and suggested methods for circumventing those problems have been discussed. Because of the strong recommendation for the use of partial correlations that have been corrected for attenuation, this

method was chosen to analyze the four major hypotheses of this study. However, it was decided to also use the other methods that have been mentioned: Lord and Novick's (1968) method for correcting correlations with difference scores for attenuation, partial correlations that have not been corrected for attenuation, and analyses that use raw difference scores. The reasons for using these divergent methods instead of the one method to analyze the hypotheses stems from a desire for caution. Given the many problems associated with the use of difference scores, readers should be equally cautious in their interpretation of the results.

One weakness of both Lord and Novick's (1968) method of correcting correlations with difference scores for attenuation and the method of partial correlation is that they are not amenable to the examination of curvilinear relationships. Because the investigation of curvilinear relationships is an integral part of this study, and because the difference measures obtained in this study were fairly reliable, it was decided that analyses with raw difference scores would be carried out in addition to the alternative methods described above. Further, when analyzing difference scores, Kenny (1975, p. 359) suggested that one might want to use multiple methods. Since each method might have a different bias, convergence of results would lend greater confidence to the results. On the other hand, a lack of convergence could cast doubt as to the reliability of the results.

Although the use of raw difference scores and partial correlations that have not been corrected for attenuation are subject to error, they represent "empirical" findings. The two methods that employ correction for attenuation represent "hypothetical" findings. That is to say, the hypothetical findings are the findings that would be expected if perfectly reliable measures were available, while the empirical findings are the findings that are found with the fallible measures of this study. While the empirical and the hypothetical findings both have potential practical and theoretical implications, the empirical findings have greater practical interests, for they can provide information about what occurs when the fallible measures of this study are used. The hypothetical findings are of greater theoretical interest, since being subject to less error, they can provide information about what occurs between the theoretical constructs of interest to this study. The results of the four major hypotheses are presented in the next section. Each hypothesis will be examined "empirically" and "hypothetically".

E. Tests of the Four Main Hypotheses

The four main hypotheses outlined in Chapter Three will be dealt with separately. The results have been divided into "empirical" and "hypothetical" findings in order to retain the distinction between analyses which have been corrected for attenuation (i.e., "hypothetical") and analyses which have not been corrected for

attenuation (i.e., "empirical"). A summary of the findings for all four hypotheses will be provided at the end of this section.

Hypothesis One

The first hypothesis can be phrased two ways such that the first version applies to analyses which make use of change scores, while the second version applies to partial correlation analyses. The two versions of hypothesis one are as follows:

1. Change in arousal is a positive linear function of change in incentive.
2. After statistically controlling for regular season incentive and regular season arousal, championship incentive will correlate with championship arousal in a positive direction.

Two methods were employed to analyze the first version of hypothesis one: a Pearson correlation between change in arousal and change in incentive, and that same Pearson correlation corrected for attenuation, as suggested by Lord and Novick (1968, p. 76). Similarly, two methods were used to analyze the second version of hypothesis one: a partial correlation between championship arousal and championship incentive with regular season arousal and regular season incentive partialled out, and that same partial correlation corrected for attenuation. The results of these analyses are reported in Table IV-4.

Table IV-4

Analyses of the Linear Relationship between Incentive and Arousal

Dependent Variable	Independent Variable	Partialed Variables	"Empirical" uncorrected r	"Hypothetical" corrected r
Change in Arousal	Change in Incentive	---------	.27 *	.49
Arousal 2	Incentive 2	Arousal 1 Incentive 1	.30 *	.55

Note. The "hypothetical" analyses were not examined for significance.

* $p < .05$

As indicated in Table IV-4, both methods of analysis before correcting for attenuation provided empirical support for the first hypothesis. The Pearson correlation between change in arousal and change in incentive was .27 ($p<.05$) without correcting for attenuation. The partial correlation prior to correction for attenuation was .30 ($p<.05$). Although they cannot be conveniently examined for significance, the hypothetical relationships which were corrected for attenuation were in the same positive direction as the uncorrected, empirical relationships. As Lord (1974, p. 212) noted, correcting a partial correlation for attenuation due to the unreliability of the measures can change the direction of the uncorrected partial correlation. The corrected change score relationship was .49 and the corrected partial correlation was .55. In conclusion, change in arousal appears to be related to a change in incentive, as predicted. Also, championship arousal appears to be related to a swimmer's championship incentive, when controlling for regular season incentive and arousal. In other words, the swimmers who experienced the largest gains in arousal from the regular season to the championship tended to have also experienced large gains in incentive from the regular season to the championship. The results presented in Table IV-4 converge in their support of the first hypothesis.

Hypothesis Two

-Hypothesis two, like the first hypothesis, can be phrased in two ways such that the first version applies to analyses which make use of change scores, while the second version applies to partial correlation analyses. The second version does not address the question of a curvilinear relationship because partial correlations can only be applied to linear relationships. The two versions of hypothesis two are as follows:

1. (A) Change in performance is a negative linear function of change in arousal.

   (B) Change in performance is a nonlinear (curvilinear in the shape of an inverted U) function of change in arousal.

2. After statistically controlling for regular season arousal and regular season performance, championship arousal will correlate with championship performance in a negative direction.

Two methods were employed to analyze part (A) of the first version of hypothesis two: a Pearson correlation between change in performance and change in arousal, and that same Pearson correlation corrected for attenuation, as suggested by Lord and Novick (1968, p. 76). Similarly, two methods were used to analyze the second version of hypothesis two: a partial correlation between championship performance and championship arousal with regular season performance and regular season arousal partialled out, and that same partial correlation corrected for attenuation. The results of these analyses are reported in Table IV-5. One method was used to analyze part (B) of the first

Table IV-5

Anālyses of the Linear Relationship between Arousal and Performance

Dependent Variable	Independent Variable	Partialed Variables	"Empirical" uncorrected r	"Hypothetical" corrected r
Change in Performance	Change in Arousal	---------	-.25 *	-.35
Performance 2	Arousal 2	Performance 1 Arousal 1	-.21 *	-.35

Note. The "hypothetical" analyses were not examined for significance.

* $p < .05$

version of hypothesis two. First, change in performance was regressed onto change in arousal, then the square of change in arousal was entered into the equation. The incremental explained variance in change in performance due to the square of change in arousal over and above that explained by change in arousal was then assessed. This latter effect, if significant, would imply a strong nonlinear (curvilinear) component in the relationship between change in arousal and change in performance. The result of this analysis is reported in Table IV-6.

As indicated in Table IV-5, both methods of analysis before correcting for attenuation provided empirical support for the second hypothesis. The Pearson correlation between change in arousal and change in performance was -.25 ($p<.05$) without correcting for

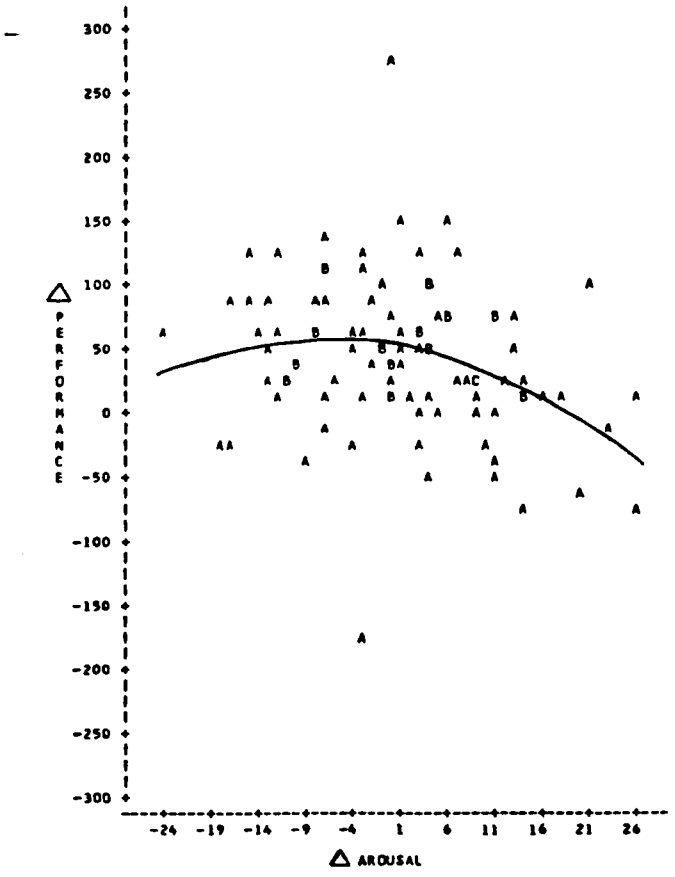
Table IV-6

Analysis of the Curvilinear Relationship between Change in Arousal and Change in Performance

Dependent Variable	Independent Variables	R^2	incremental R^2
Change in Performance	Change in Arousal	.06 *	.06 *
Change in Performance	Change in Arousal + (Change in Arousal)^2	.10 *	.04 *

* $p < .05$

attenuation. The partial correlation prior to correction for attenuation was -.21 ($p<.05$). The hypothetical relationships which were corrected for attenuation were not examined for significance, but they were in the same negative direction as the uncorrected, empirical relationships. The corrected change score relationship was -.35 and the corrected partial correlation was -.35. As indicated in Table IV-6, there was also evidence of a curvilinear component to the relationship between change in arousal and change in performance ($\triangle R^2=.04$, $p<.05$). Inspection of the scatterplot, depicted in Figure IV-4, indicated that the curvilinear relationship resembled an inverted U.



$$\triangle \text{Performance} = 52.93 - 1.16\ (\triangle \text{Arousal}) - .08\ (\triangle \text{Arousal}^2)$$

Figure IV-4. Scatterplot of change in performance and change in arousal.

In conclusion, change in performance appears to be negatively related to a change in arousal, as predicted. Also, championship performance appears to be negatively related to a swimmer's championship arousal, when controlling for regular season arousal and performance. Finally, there appears to be a curvilinear component in the form of an inverted U in the relationship between change in performance and change in arousal. In other words, the swimmers who experienced the largest gains in performance from the regular season to the championship tended to have also experienced small changes in arousal from the regular season to the championship, while the swimmers who experienced small or even decremental changes in performance from the regular season to the championship tended to have also experienced large changes in arousal, most of these changes being gains in arousal but some being losses in arousal, from the regular season to the championship. The results presented in Table IV-5 and Table IV-6 converge in their support of the second hypothesis.

Hypothesis Three

Hypothesis three can also be phrased two ways such that the first version applies to the analyses which make use of change scores, while the second version applies to the partial correlation analyses. The second version does not address the question of a curvilinear relationship because partial correlations can only be applied to linear relationships. The two versions of hypothesis three are as follows:

1. (A) Change in performance is a negative linear function of change in incentive.

   (B) Change in performance is nonlinear (curvilinear in the shape of an inverted U) function of change in incentive.

2. After statistically controlling for regular season incentive and regular season performance, championship incentive will correlate with championship performance in a negative direction.

Two methods were employed to analyze part (A) of the first version of hypothesis three: a Pearson correlation between change in performance and change in incentive, and that same Pearson correlation corrected for attenuation, as suggested by Lord and Novick (1968, p. 76). Similarly, two methods were used to analyze the second version of hypothesis three: a partial correlation between championship performance and championship incentive with regular season performance and regular season incentive partialled out, and that same partial correlation corrected for attenuation. The results of these analyses are reported in Table IV-7. One method was used to analyze part (B) of the first version of hypothesis three. First, change in performance was regressed onto change in incentive, then the square of change in incentive was entered into the equation. The incremental explained variance in change in performance due to the square of change in incentive over and above that explained by change in incentive was then assessed. This latter effect, if significant, would imply a strong nonlinear (curvilinear) component in the relationship between

Table IV-7

Analyses of the Linear Relationship between Incentive and Performance

Dependent Variable	Independent Variable	Partialed Variables	"Empirical" uncorrected r	"Hypothetical" corrected r
Change in Performance	Change in Incentive	---------	-.19	-.36
Performance 2	Incentive 2	Performance 1 Incentive 1	-.22 *	-.52

Note. The "hypothetical" analyses were not examined for significance.

* $p < .05$

change in incentive and change in performance. The result of this analysis is reported in Table IV-8.

As indicated in Table IV-7, only one of the two methods of analysis before correcting for attenuation provided empirical support for the third hypothesis. The partial correlation prior to correction for attenuation was -.22 ($p<.05$), but the Pearson correlation between change in incentive and change in performance was -.19 ($p>.05$) without correcting for attenuation. The hypothetical relationships which were corrected for attenuation were not examined for significance, but they were in the same negative direction as the uncorrected, empirical relationships. The corrected change score relationship was -.36 and

Table IV-8

Analysis of the Curvilinear Relationship between Change in Incentive and Change in Performance

Dependent Variable	Independent Variables	R^2	incremental R^2
Change in Performance	Change in Incentive	.04	.04
Change in Performance	Change in Incentive + (Change in Incentive) ^{2}	.04	.00

* $p < .05$

the corrected partial correlation was -.52. As indicated in Table IV-8, there was no evidence of a curvilinear component to the relationship between change in incentive and change in performance ($\triangle R^2 = .00$, $p > .05$).

In conclusion, there appears to be some support for the third hypothesis. Change in performance, while not significant at a conventional levels ($p < .05$), did appear to be negatively related to a change in incentive ($p = .056$), as predicted. However, there was no evidence for a curvilinear component to the relationship between change in performance and change in incentive, contrary to prediction. Championship performance was also negatively related to a swimmer's championship incentive, after controlling for regular season incentive and performance, as predicted.

While the uncorrected, empirical relationship between (raw score) change in incentive and change in performance was nonsignificant, the facts that (1) it was in a negative direction, and (2) it was of a sufficiently high magnitude ($p=.06$) to claim that the probability of it occurring by chance was less than one in fifteen, suggest that there may be at least a slight tendency for swimmers who experienced large gains in performance from the regular season to the championship to have also experienced small changes in incentive, and also a slight tendency for the swimmers who experienced small changes in performance to have also experienced large gains in incentive.

Hypothesis Four

The fourth hypothesis, like the first three, can be phrased two ways such that the first version concerns analyses for change scores and the second version concerns partial correlation analyses. Again, the second version does not address the question of a curvilinear relationship because partial correlations can only be applied to linear relationships. The two versions of hypothesis four are as follows:

1. (A) There will be no significant incremental explained variance in change in performance due to change in incentive over and above that explained by change in arousal.

(B) There will be no significant incremental explained variance in change in performance due to change in incentive over and above that explained by the combination of change in arousal and the square of change in arousal.

2. After statistically controlling for championship arousal and regular season incentive, arousal, and performance, championship incentive will not correlate with championship performance.

Two methods were employed to analyze part (A) of the first version of hypothesis four. First, change in performance was regressed onto change in arousal, then change in incentive was added to the equation. The incremental explained variance in change in performance due to change in incentive over and above that explained by change in arousal was then assessed. This latter effect, if nonsignificant, would imply that the relationship between change in performance and change in incentive (marginally supported in the analysis of hypothesis three) could be explained by change in arousal. The second analysis repeated the one described above except that the relationship was corrected for attenuation. In order to correct this relationship for attenuation, it was necessary to convert the R^2's into zero order correlations. This process is explained in Appendix D. The results of these analyses are reported in Table IV-9 under the heading of "Regression of Linear Relationships". A similar method was used to analyze part (B) of the first version of hypothesis four. First, change in arousal combined with the square of change in arousal was assessed in relation to change in performance. Then change in incentive combined with change in arousal and the square of change in arousal was assessed in

Table IV-9

Regression Analyses of the Incremental Explained Variance in Change in Performance Due to Change in Incentive Over and Above that Explained by Change in Arousal

Dependent Variable	Independent Variables	"Empirical" uncorrected R^2	"Empirical" incremental R^2	"Hypothetical" corrected R^2	"Hypothetical" incremental R^2
	Regression of Linear Relationships				
Change in Performance	Change in Arousal	.06 *	.06 *	.12	.12
Change in Performance	Change in Arousal + Change in Incentive	.11 *	.05 *	.17	.05
	Regression of Linear and Curvilinear Relationships				
Change in Performance	Change in Arousal + Change in Arousal ^{2}	.10 *	.10 *	-----	-----
Change in Performance	Change in Arousal + Change in Arousal ^{2} + Change in Incentive	.15 *	.05 *	-----	-----

Note. The equations used to compute the R^2's corrected for attenuation appear in Appendix D. These "hypothetical" R-'s were not examined for significance.

* $p < .05$

relation to change in performance. The incremental explained variance in change in performance due to change in incentive over and above that explained by change in arousal and the square of change in arousal was then assessed. This latter effect, if nonsignificant, would imply that the relationship between change in performance and change in incentive (marginally supported in the analysis of hypothesis three) could be explained by the combination of change in arousal and the square of change in arousal. The result of this analysis is reported in Table IV-9 under the heading of "Regression of Linear and Curvilinear Relationships".

Two methods were employed to analyze the second version of hypothesis four: the partial correlation between championship performance and championship incentive with regular season performance, regular season incentive, regular season arousal, and championship arousal partialled out, and that same partial correlation corrected for attenuation. The results of these analyses are reported in Table IV-10.

As indicated in Table IV-9, both methods of analysis before correcting for attenuation, linear and linear combined with curvilinear, failed to provide empirical support for the first version of the fourth hypothesis. Change in incentive was able to explain variance in change in performance over and above that explained by change in arousal ($\triangle R^2 = .05$, $p < .05$) and over and above that explained by the combination of change in arousal and the square of change in

Table IV-10

Partial Correlation Analysis of the Relationship between Incentive and Performance Controlling for Arousal, Initial Incentive, and Initial Performance

Dependent Variable	Independent Variable	Partialed Variables	"Empirical" uncorrected r	"Hypothetical" corrected r
Performance 2	Incentive 2	Performance 1 Incentive 1 Arousal 1 Arousal 2	-.15	-.46

Note. The "hypothetical" analysis was not examined for significance.

* $p < .05$

arousal ($\triangle R^2$=.05, p<.05). However, as indicated in Table IV-10, there was empirical support for the second version of the fourth hypothesis. Before correcting for attenuation, the partial correlation between championship performance and championship incentive was nonsignificant (r=-.15, p>.05), even when controlling for regular season performance, regular season incentive, regular season arousal, and championship arousal. The hypothetical analyses which were corrected for attenuation were not examined for significance. These results are presented in Table IV-9 ($\triangle R^2$=.05) and in Table IV-10 (r=-.46).

Because this hypothesis is stated negatively (i.e., the results are not expected to be significant), the typical .05 alpha level becomes equated with the chance of committing a Type II error, and one minus beta (power) becomes equated with the chance of committing a Type 1 error. Because the power of the analyses used to evaluate hypothesis four are limited, evidence in support of hypothesis four will tend to be less conclusive than evidence that refutes hypothesis four. Therefore, the results of the regression analyses that refute hypothesis four are likely to occur by chance less than one time in twenty, while the nonsignificant, uncorrected partial correlation result that supports hypothesis four could have been due to a lack of power.

In conclusion, the empirical findings failed to converge in their support or refutation of hypothesis four. While the uncorrected partial correlation result supported hypothesis four, there is a

question about the strength of this conclusion. The nonsignificant result could have been due to a lack of power. Because it could not be shown conclusively that the relationship between change in incentive and change in performance was mediated entirely by change in arousal, it appears that while part of the relationship between incentive change and performance change seems to be mediated by arousal change, incentive change appears to influence performance change independent of arousal change.

Summary

The evidence for hypothesis one was strong. Change in arousal appears to be a positive linear function of change in incentive. The evidence for the linear part of hypothesis two was also strong. Change in performance appears to be a negative linear function of change in arousal. Although the evidence was not quite as strong, change in performance also appears to be curvilinearly related to change in arousal in the form of an inverted U, as theory would predict. The evidence for the linear part of hypothesis three was not as conclusive in showing that change in performance may be a negative linear function of change in incentive. It is felt that this hypothesis was more difficult to support due to the poor reliability of change in incentive. The curvilinear part of hypothesis three was not supported. Thus, change in performance does not appear to be curvilinearly related to change in incentive. The evidence was mixed in support of hypothesis four. Change in incentive appears to act

both through change in arousal and independently to influence change in performance.

F. Exploratory Findings

Effort-Performance Expectancy

Motivation, as conceptualized in expectancy theory, has three components: effort-performance expectancy, performance-outcome expectancy, and outcome valence. The latter two components were measured to obtain the incentive variable used in this study. Effort-performance expectancy, the subjective probability that one's effort will lead to successful performance, was also measured as it represents the other half of the motivation equation and might provide additional insight into the motivation-performance relationship.

Effort-performance expectancy (hereafter referred to as expectancy) was measured with a single item. The swimmers were asked to predict the likelihood (from 0 to 100%) of their swimming one of their fastest times, if they put forth a good effort. A copy of the item can be found in Appendix A. Since expectancy was measured only once during the regular season and only once during the championship, neither the test-retest reliability of regular season expectancy nor the test-retest reliability of championship expectancy could be determined. Also, no measures of internal consistency could be computed because expectancy was measured with a single item. In short,

the psychometric properties of this instrument are largely unknown. Thus, the inferential results regarding expectancy must be viewed with some caution.

The first exploratory test of expectancy concerned whether it changed from one experimental condition to the other, from the regular season to the championship. Because of the special training techniques the swimmers underwent to improve their performance during the championship, the swimmers' were expected to increase their effort-performance expectancy beliefs. In other words, the swimmers were expected to have a stronger belief that their efforts would lead to a fast time during the championship than during the regular season. This expectation was supported ($t=2.95$, $p<.05$). The results are reported in Table IV-11.

As indicated in Table IV-12, it also seems apparent that the increase in expectancy, a feeling that effort was more likely to lead to successful performance during the championship than during the regular season, was significantly associated with a decrease in arousal ($r=-.22$, $p<.05$). Thus, change in expectancy appeared to affect change in arousal in the opposite direction that change in incentive affected change in arousal ($r=.27$, $p<.05$). Since change in expectancy and change in incentive both increased from the regular season to the championship, they appear to have had countervailing influences on arousal, incentive driving arousal up and expectancy pulling arousal

Table IV-11

Descriptive Statistics and T-Test for Expectancy

Variable	n	mean	std. dev.	skewness	kurtosis	t-test
Expectancy 1	103	73.72	25.52	-.10	-.10	
Expectancy 2	98	80.08	25.23	-.05	.60	
Change in Expectancy	92	8.41	27.33	.15	.59	2.95 *

* $p < .05$

Table IV-12

Correlations and Partial Correlations between Expectancy and Incentive, Arousal, and Performance

Dependent Variables	Partialed Variables	Change in Expectancy	Expectancy 2
Change in Incentive	---------	.10	---
Change in Arousal	---------	-.22 *	---
Change in Performance	---------	.10	---
Incentive 2	Incentive 1 Expectancy 1	---	.16
Arousal 2	Arousal 1 Expectancy 1	---	-.06
Performance 2	Performance 1 Expectancy 1	---	.05

* $p < .05$

down. This would explain why arousal did not increase from the regular season meet to the championship meet as it was expected to.

However, the correlation between change in arousal and change in expectancy is not consistent with the partial correlation between championship arousal and championship expectancy when controlling for regular season arousal and regular season expectancy ($r=-.06$, $p>.05$), as reported in Table IV-12. Because there are no reliability measures of expectancy, the partial correlation analysis cannot be corrected for attenuation due to the unreliability of expectancy. Nonetheless, for swimmers with the same expectancy and arousal for the regular season, there was no evidence of a relationship between expectancy and arousal for the championship. The lack of congruence between the partial correlation and the change score correlation makes interpretation of the relationship between expectancy change and arousal change difficult. The suggestion in the previous paragraph that expectancy increases from the regular season to the championship appear to lower arousal may be premature. Nonetheless, increases in expectancy from the regular season to the championship were related to decreases in arousal from the regular season to the championship, perhaps due to some other unmeasured variable which influenced expectancy and arousal.

Biographical Variables

The gender, age, and years of experience of the swimmers were measured to see whether any of these attributes influenced the motivation-arousal-performance relationship. While the investigation of these three biographical variables was exploratory, it is of some interest to determine, for example, whether the younger or less experienced swimmers experienced a greater increase in incentive and arousal from the regular season to the championship, and thus, experienced less of a gain in performance than the older or more experienced swimmers. The relationships between the biographical variables and changes in expectancy, incentive, arousal, and performance were assessed with partial correlations uncorrected for attenuation and corrected for attenuation. These results are presented in Table IV-13. Pearson correlations between the biographical variables and regular season and championship expectancy, incentive, arousal, and performance were also computed. These results are presented in Table IV-14.

The relationships of age with changes in expectancy, incentive, arousal, and performance will be examined first. As reported in Table IV-13, there were no significant partial correlations involving age. With performance for example, there was no relationship between championship performance and age when controlling for regular season performance ($r=.14$, $p>.05$). However, as reported in Table IV-14, the older swimmers were faster, on average, during the regular season and

Table IV-13

Partial Correlations of Biographical Variables with Championship Expectancy, Incentive, Arousal, and Performance

Biographical Variable	Expectancy 2 (Expectancy 1)		Incentive 2 (Incentive 1)		Arousal 2 (Arousal 1)		Performance 2 (Performance 1)	
	r		r	cr	r	cr	r	cr
Age	-.12		.09	.11	-.04	-.05	.14	.10
Years Experience	-.06		-.05	-.20	.01	-.01	.28	* .27
Gender (M=1; F=2)	.15		.11	.06	-.13	-.13	-.18	-.12

Note. The parenthetic variables above were the partialed variables. Also, the partial correlations under the "r" columns have not been corrected for attenuation. Those under the "cr" columns have been corrected for attenuation due to the unreliability of the measures. The analyses corrected for attenuation were not examined for significance.

* $p < .05$

Table IV-14

Correlations of Biographical Variables with Expectancy, Incentive, Arousal, and Performance

Biographical Variable	Expectancy		Incentive		Arousal		Performance	
	RS	CH	RS	CH	RS	CH	RS	CH
Age	-.37 *	-.24 *	-.21 *	-.13	-.02	-.05	.32 *	.26 *
Years Experience	-.17	-.10	-.07	-.18	.04	.01	.06	.27 *
Gender (M=1; F=2)	-.11	.09	.33 *	.33 *	.17	-.04	-.02	-.09

Note. RS stands for regular season. CH stands for championship.

* $p < .05$

also during the championship ($r=.32$, $p<.05$; $r=.26$, $p<.05$; respectively). The older swimmers also had lower expectancy beliefs during the regular season and the championship ($r=-.37$, $p<.05$; $r=-.24$, $p<.05$; respectively). Finally, the older swimmers had lower incentive scores during the regular season ($r=-.21$, $p<.05$). In sum, although the older swimmers were better performers and approached the competitions with less motivation, on average, both younger and older swimmers appeared to experience similar changes in expectancy, incentive, arousal, and performance from the regular season to the championship.

For swimmers with more competitive swimming experience, their experience was more of a factor during the championship than during the regular season. The significant partial correlation reported in Table IV-13 between years experience and performance ($r=.28$, $p<.05$) indicates that for swimmers at the same regular season performance level, swimmers with more experience tended to perform better during the championship than swimmers with less experience. As reported in Table IV-14, years of experience was not related to regular season performance ($r=.06$, $p>.05$), but was related to championship performance ($r=.27$, $p<.05$). The more experienced swimmers apparently approached the meets differently from their less experienced teammates. The more experienced swimmers performed better during the championship and they experienced a greater gain in performance during the championship.

As reported in Table IV-13, gender was not related to changes in expectancy, incentive, arousal, or performance. However, as reported in Table IV-14, gender was related to incentive for both the regular season ($r=.33$, $p<.05$) and the championship ($r=.33$, $p<.05$), with female swimmers having higher incentive levels, on average, than the male swimmers. Gender was not related to expectancy, arousal, or performance during either the regular season or the championship. Other analyses revealed, however, that male and female swimmers differed in their position on the initial, regular season arousal-performance curve. For the female swimmmers, the correlation between regular season arousal and performance was significantly negative ($r=-.44$, $p<.05$), while for the male swimmers, the correlation was nonsignificant ($r=-.01$, $p>.05$). These correlations suggest that the females were overaroused and that the males were near optimum arousal during the regular season.

Because the males and females started at different positions on the regular season arousal-performance curve, the relationships between change in arousal and change in performance should be different for males and females. Since increased arousal should impair the performance of the already overaroused females, while decreased arousal should aid performance, a negative relationship would be expected between change in arousal and change in performance for the female swimmers. A significantly negative correlation was, in fact, found ($r=-.38$, $p<.05$) for the female swimmers.

Since the male swimmers started near the top of the regular season arousal-performance curve, both decreases and increases in arousal would be expected to impair performance. Therefore, a curvilinear relationship in the shape of an inverted U would be expected between change in arousal and change in performance for the male swimmers, with change in arousal squared entered into the equation for change in performance. This expectation was confirmed (R^2=.08, $p<.05$). The linear relationship between change in arousal and change in performance was nonsignificant for the male swimmers ($r=-.14$, $p>.05$).

In addition to being at different points on the regular season arousal-performance curve, the male and female swimmers differed in other ways. As reported in Table IV-15, the female swimmers experienced a significant increase in expectancy from the regular season to the championship ($t=3.89$, $p<.05$), while the male swimmers did not ($t=.74$, $p>.05$). On the other hand, the male swimmers experienced a significant increase in arousal from the regular season to the championship ($t=2.23$, $p<.05$), while the female swimmers, on average, did not ($t=-.72$, $p>.05$). In fact, from the regular season to the championship, the females experienced a reduction in arousal, although not a significant one. Both incentive and performance increased significantly from the regular season to the championship for both males and females.

In spite of starting at different positions on the regular season arousal-performance curve and undergoing different changes in arousal

Table IV-15

T-Tests for Change in Expectancy, Incentive, Arousal, and Performance by Gender

	Variable	Mean	Variable	Mean	t
Female Means n=50	Expectancy 1	70.65	Expectancy 2	82.34	3.89 *
	Incentive 1	2963.33	Incentive 2	3204.89	2.54 *
	Arousal 1	46.38	Arousal 2	45.40	-.72
	Performance 1	586.24	Performance 2	625.52	3.16 *
Male Means n=61	Expectancy 1	76.40	Expectancy 2	78.00	.74
	Incentive 1	2410.83	Incentive 2	2580.59	3.42 *
	Arousal 1	43.23	Arousal 2	46.23	2.23 *
	Performance 1	588.83	Performance 2	638.62	5.19 *

* $p < .05$

and expectancy, the male and female swimmers tended to react in a similar fashion to changes in incentive and arousal, with incentive changes tending to be positively related to arousal changes and with both incentive and arousal changes tending to be negatively related to performance changes. However, as indicated in Table IV-16, the strength of these relationships varied by gender. This was especially true of (1) the relationship between championship performance and championship arousal when controlling for regular season performance and regular season arousal and (2) the relationship between championship performance and championship incentive when controlling for regular season performance and incentive. The uncorrected partial correlations for the former relationship were -.26 ($p<.05$) for the female swimmers and -.18 ($p>.05$) for the male swimmers. For the latter relationship, the uncorrected partial correlations were -.27 ($p<.05$) for the female swimmers and -.18 ($p>.05$) for the male swimmers. The gender differences in this situation could have been due to the male and female swimmers' being at different points on the regular season arousal-performance curve. Because the females were more overaroused, on average, increases in their arousal should impair their performance, while decreases in their arousal should aid their performance. As was mentioned, a significantly negative correlation between change in arousal and change in performance was found for the female swimmers ($r=-.38$, $p<.05$). Because the male swimmers were closer to optimum arousal during the regular season, on average, more male swimmers than female swimmers were likely to be underaroused during the regular season. For these underaroused male swimmers, increases in

Table IV-16

Partial Correlations between Incentive, Arousal, and Performance by Gender

Dependent Variable	Independent Variable	Variables Partialed Out	Females r	Females cr	Males r	Males cr
Arousal 2	Incentive 2	Arousal 1 Incentive 1	.28 *	.47	.31 *	.50
Performance 2	Arousal 2	Performance 1 Arousal 1	-.26 *	-.36	-.18	-.25
Performance 2	Incentive 2	Performance 1 Incentive 1	-.27 *	.53	-.18	-.49

Note. The partial correlations under the two "r" columns have not been corrected for attenuation. Those under the two "cr" columns have been corrected for attenuation due to the unreliability of the measures. The analyses corrected for attenuation were not examined for significance.

* $p < .05$

arousal should improve their performance, and a positive relationship between change in arousal and change in performance would be expected for them. This would dilute the negative relationship expected for the rest of the male swimmers. As was mentioned, the relationship between change in arousal and change in performance for the male swimmers was -.14 ($p>.05$).

In summary, although gender and age may be related to expectancy, incentive, arousal, or performance levels during a competition, they apparently do not strongly influence the dynamics of the motivation-arousal-performance model investigated in this study. Years of competitive swimming experience, on the other hand, may influence a swimmer's approach to the different competitive situations, regular season or championship. The less experienced swimmers tended to not improve as much during the championship meets as their more experienced teammates.

Trait Anxiety Variables

Trait anxiety was measured because it was felt that trait anxiety may influence the role played by arousal in the motivation-performance relationship. Because high trait anxious individuals react to ego threatening situations with a disproportionate amount of anxiety, the high trait anxiety swimmers were expected to not only experience more arousal in the regular season and the championship, they were also expected to experience a greater gain in arousal from the regular

season to the championship, and thus, not improve their performance as much as their less trait anxious teammates.

Partial correlations were computed to see whether the trait anxiety measures correlated with expectancy, incentive, arousal, and performance for the championship while partialing out expectancy, incentive, arousal, and performance for the regular season. In other words, do high trait anxious swimmers react differently from low trait anxious swimmers to championship competitions? Positive relationships were expected to be found between trait anxiety measures and incentive and arousal, while negative relationships were expected between trait anxiety measures and performance. This is what was generally found. However, most of the relationships were not significant. These results are presented in Table IV-17.

Pearson correlations between the trait anxiety variables and expectancy, incentive, arousal, and performance for the regular season and the championship are reported in Table IV-18. Nervousness, which was a measure completed by the coaches to assess each swimmer's nervousness before competition, was related to incentive during the regular season meet ($r=.26$, $p<.05$). Trait anxiety (a measure of general anxiety) and sports competition anxiety, while not good predictors of incentive, were very good predictors of arousal. Trait anxiety was significantly related to regular season arousal ($r=.49$, $p<.05$) and to championship arousal ($r=.40$, $p<.05$). Sports Competition anxiety was also significantly related to regular season arousal

Table IV-17

Partial Correlations of Trait Anxiety Variables with Championship Expectancy, Incentive, Arousal, and Performance

Trait Anxiety Variable	Expectancy 2 (Expectancy 1) r	Incentive 2 (Incentive 1) r	Incentive 2 (Incentive 1) cr	Arousal 2 (Arousal 1) r	Arousal 2 (Arousal 1) cr	Performance 2 (Performance 1) r	Performance 2 (Performance 1) cr
Trait Anxiety	.11	.13	.19	.21	.23	-.06	-.03
Sports Competition Anxiety	.15	.11	.20	.29 *	.31	-.16	-.16
Nervousness	.13	.15	-.11	.15	.14	-.11	-.06

Note. The parenthetic variables above were the partialed variables. Also, the partial correlations under the "r" columns have not been corrected for attenuation. Those under two "cr" columns have been corrected for attenuation due to the unreliability of the measures. The analyses corrected for attenuation were not examined for significance.

* $p < .05$

Table IV-18

Correlations of Trait Anxiety Variables with Expectancy, Incentive, Arousal, and Performance

Trait Anxiety Variable	Expectancy		Incentive		Arousal		Performance	
	RS	CH	RS	CH	RS	CH	RS	CH
Trait Anxiety	.04	.04	-.08	.03	.49 *	.40 *	-.06	-.07
Sports Competition Anxiety	-.13	.05	-.05	.06	.43 *	.44 *	-.14	-.21
Nervousness	.03	.00	.26 *	.18	.14	.19	-.30 *	-.22 *

Note. RS stands for regular season. CH stands for championship.

* $p < .05$

(r=.43, p<.05) and to championship arousal (r=.44, p<.05). All of the trait anxiety measures were negatively related to the two performance measures. However, nervousness was the only one that was significantly related. The Nervousness measure appears to be a better measure of swimming performance than of trait anxiety. The correlations between nervousness and regular season and championship performance (r=-.30, p<.05; r=-.22, p<.05; respectively) were higher than the correlations between nervousness and regular season and championship arousal (r=.14, p>.05; r=.19, p>.05; respectively).

In sum, the sports specific anxiety measure, Sports Competition Anxiety, appears to offer the most promise as a predictor of which swimmers are more likely to improve or self destruct in the face of championship competition. However, none of the trait anxiety measures were particularly strong in this respect. The Sports Competition Anxiety measure was effective in predicting which swimmers would be more likely to become overaroused during championship competition. The partial correlation between championship arousal and sports competition anxiety while partialing out regular season arousal was .29 (p<.05). One of the implications of this research is that swimmers need to keep from overreacting to championship competitions. This may be especially true for swimmers who have a lot of sports competition anxiety.

G. Summary

Two assumptions underscoring this study were (1) that the swimmers were near their optimum level of arousal during the regular season and (2) that because of increases in incentive, they became overaroused during the championship. These assumptions were not supported. However, there was some evidence that the swimmers might have been, on average, slightly overaroused for both the regular season and the championship. If this slghtly overaroused interpretation of the data is correct, then the major hypotheses would still be tenable. However, the interpretation of the swimmers being slightly overaroused must be accepted with caution.

Each of the major hypotheses was analyzed a number of ways in an effort to overcome some of the problems inherent in change score analysis. To briefly recount, strong evidence was found in support of a positive relationship between change in incentive and change in arousal. There was also strong evidence for a negative, nonlinear (in the shape of an inverted U) relationship between change in arousal and change in performance. Less strong was the evidence in support of a negative relationship between change in incentive and change in performance. No evidence, however, was found for a nonlinear relationship between change in incentive and change in performance. Finally, change in arousal did not appear to fullly mediate the relationship between change in incentive and change in performance, as

change in incentive appeared to acccount for unique variance in change in performance that was not acccounted for by change in arousal.

It was also found that the dynamics of the incentive-arousal-performance relationship appear to function across age, gender, and years of experience. In addition, although inconclusive, some evidence was found that trait anxiety, especially the situation specific sports competition anxiety, may moderate the incentive-arousal-performance relationship, such that increases in incentive, especially threatening social or self-mastery incentives, may cause individuals with higher trait anxiety to experience greater increases in arousal, and subsequently, greater decreases in performance.

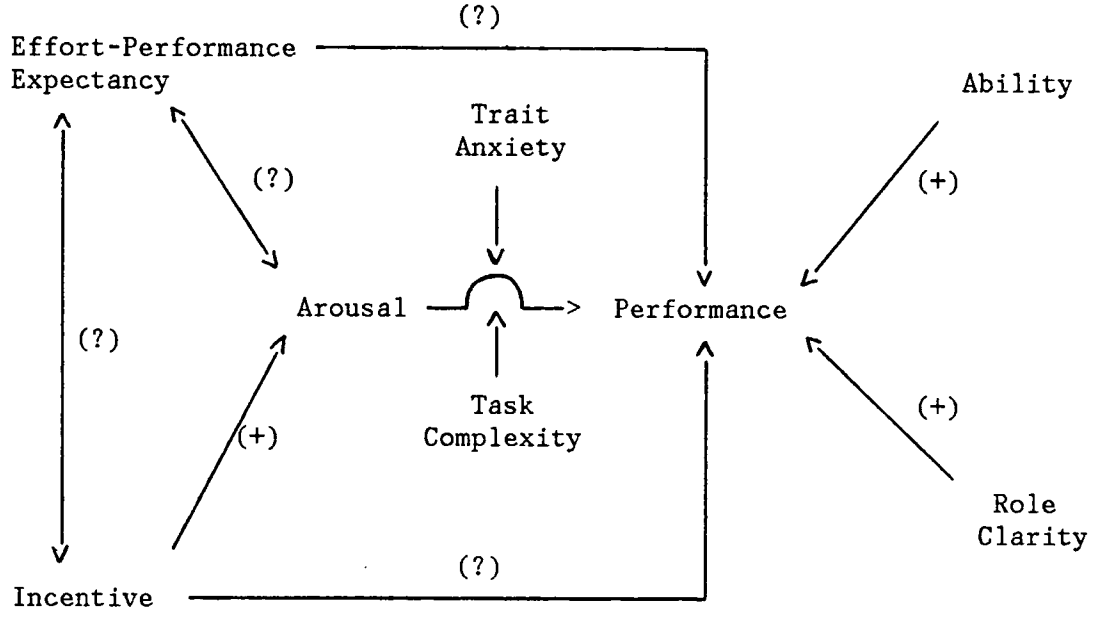
CHAPTER V

DISCUSSION

In order to better interpret the results presented in the previous chapter, it would be helpful to review the proposed model of the motivation-arousal-performance relationship that was developed in the summary of the Literature Review. The essential difference between this model and alternative models is the inclusion of arousal in this model. The model, depicted Figure II-1, is reproduced here in Figure V-1.

Both the effort-performance expectancy and the incentive components of expectancy theory have proven to be effective predictors of performance. It may be asked, however, why, exactly, should increases in perceived incentive lead to increases in performance? One reason might be that in increasing an individual's incentive to behave in some manner to obtain a desired outcome, the individual becomes more energized, more aroused to behave, and the results of this study clearly support that view.

If incentive and arousal are related, an important implication for the motivation-performance relationship would be that incentive, if it gets too high, can impair performance, under certain circumstances.



Incentive is a function of
the sum of the products of
performance-outcome expectancies
multiplied by outcome valences.

Figure V-1. A proposed model of the motivation-arousal-performance relationship.

Specifically, if an individual were at his or her optimal arousal level, the level of arousal where performance is maximized, or if an individual were overaroused, then it follows that an increase in the individual's incentive level could impair his or her performance, because the individual's arousal level might become too high for effective performance. Only if an individual were underaroused prior to increasing his or her incentive level would a subsequent increase in performance be expected. The results of this study appear to support this line of reasoning for three reasons. One, incentive changes were positively related to arousal changes. Two, there was some evidence that the swimmers, as a group, were slightly overaroused during the regular season. Finally, as would be expected of individuals slightly overaroused, the swimmers who experienced the greatest increases in incentive from the regular season to the championship tended to improved their performance the least.

In sum, the model appears to be a useful extension of existing models of of the motivation-performance relationship, and one consistent with the results of the present study. One implication of the proposed model is that the relationship between change in incentive and change in performance should be mediated to a large extent by change in arousal. The results of this study, however, did not fully support that aspect of the model. Change in incentive was found to account for unique variance in change in performance over and above that accounted for by change in arousal. Nonetheless, as the results generally support the proposed model, it appears to be a

promising extension to earlier models which failed to include arousal in the motivation-performance relationship. The implications of these findings and the exploratory findings for theory and practice are discussed in the following paragraphs. The limitations of this study and suggestions for future research are also discussed.

A. Theoretical Implications

One of the benefits of a good theory is that it guides research efforts. For example, a great deal of research has been conducted in an attempt to study whether expectancy theory variables are related to effort. The purpose of this study was not to improve upon or test expectancy theory per se, but rather to broaden the scope of expectancy theory research to include explicit links (arousal) to performance.

There are two reasons for broadening the scope of expectancy theory research to include the arousal-performance relationship. First, a major objective of improving our understanding of work motivation is to better understand how to enhance an individual's performance. Therefore, knowledge of the specific relationships between motivation and performance for various tasks is vital to the final application of motivation theory. Second, it has not been empirically demonstated that more motivation necessarily and universally translates into better performance.

As noted, there seems to be an implicit assumption among many psychologists that performance is an increasing monotonic function of motivation. This same assumption seems to hold for a major component of motivation, incentive. As Lawler (1973, p.114) stated, "outcomes will motivate job performance only if they are important and appear to be tied to performance." Nothing is said about the appropriate level of incentive or whether too much incentive can impair performance as much as not enough incentive. In this study, some evidence for a negative relationship was found between change in incentive and subsequent change in performance, thus challenging the assumption that performance is necessarily an increasing monotonic function of motivation, or at least incentive. It was felt that incorporating arousal might help explain why increases in incentive may aid performance in some situations and debilitate performance in other situations.

As was demonstrated in this study and has been demonstrated in many other studies (Browne & Mahoney, 1984), performance appears to be a nonlinear (curvilinear in the shape of an inverted U) function of arousal. In the present study for example, a negative, nonlinear relationship (in the shape of an inverted U) was found between change in arousal and change in performance. Thus, it is possible for an individual's level of arousal to increase to a point where his or her performance suffers. Furthermore, if increases in incentive lead to increases in arousal, as was found in this study, and if an individual were at his or her optimal level of arousal or overaroused, as most of

the swimmers in this study appeared to be, then it seems feasible that the incentive increases could lead to the performance debilitating condition of overarousal, as was indeed the case in this study where a negative relationship was found between change in incentive and change in performance.

As noted, it was concluded that the individuals in this study were slightly overaroused during the regular season and the championship. Caution is warrented in accepting this conclusion, however, as it seems unlikely that the all the swimmers were at similar points on their arousal-performance curves. Nonetheless, three possible reasons for their having a fairly high arousal level are (1) the perception of strong incentives, which has already been discussed, (2) their youth, which could have made them especially susceptible to the pressures of high level competitive swimming, and (3) the complexity of the task they had to perform. It is a well documented phenomenon (Yerkes & Dodson, 1908; Oxendine, 1970) that the arousal-performance relationship is affected by task complexity, such that for complex tasks the level of an individual's arousal associated with optimal performance tends to be less than his or her level of arousal associated with optimal performance for simple tasks. Hence, for complex tasks, the condition of overarousal may be reached at lower levels of arousal than it would be for simple tasks. If increases in incentive lead to increases in arousal, then incentive increases should be more likely to impair performance due to overarousal when an individual is performing a complex task than when he or she is

performing a simple task. A problem may arise, however, in defining what is or is not a complex task. For example, the stroke mechanics necessary for high level competitive swimming are complex and take time to learn. But for the expert who has practiced the techniques over and over to the point where they become automatic, would the task still be considered complex for him or her? The position taken here is that well-learned, complex task behavior (e.g., swimming) may be performed almost automatically (i.e., without active cognition), but the execution of the required motor activities still constitutes complex task behavior.

As mentioned, the purpose for this study was not to improve upon expectancy theory per se, but rather to broaden the scope of expectancy theory research to include explicit links (arousal) to performance in the hope of increasing our understanding of the motivation-performance relationship. Although there are numerous and varied theories of motivation, according to Landers (1978, p. 75), "One commonality that these contemporary motivational theories and hypotheses have is that they conceptualize behavior as varying along two basic dimensions, direction and intensity." While contemporary theories do consider motivated behavior in terms of direction and intensity, Mitchell (1982) has observed that intensity or arousal is best explained by need theories or social facilitation and evaluation apprehension, while direction is best explained by process theories of motivation, such as expectancy theory, goal theory, equity theory, and operant conditioning. In other words, the study of motivation is

concerned with both the arousal of behavior and the direction of behavior, but different theories have been created to explain these different but related phenomena. It was intended that this study might provide an initial basis by which the concepts of arousal and direction could be drawn closer together by broadening the scope of expectancy theory to include arousal, as well as performance.

In addition to the results of the analyses of the major hypotheses, the exploratory tests also yielded some potentially important findings. For example, not only was incentive found to be related to arousal, but some evidence was found that effort-performance expectancy may be related to arousal as well. Also, trait anxiety may, like task complexity, be another important moderator of the arousal-performance relationship. Finally, the dynamics of the model appear to generally apply across age (at least from 13 to 21) and gender, but not across years of experience. The implications of these results follow.

Effort-performance expectancy has been shown to be related to performance (Campbell & Pritchard, 1976; Bandura, 1977; Taylor, 1987). There is also reason to believe that effort-performance expectancy and arousal are related. Bandura (1977, pp. 199-200) explained how increases in effort-performance expectancy may lead to decreases in arousal. However, he (1977, pp. 198-199) also explained how effort-performance expectancy might be a symptom of arousal, such that when an individual is overaroused, he or she might experience a

subsequent reduction in effort-performance expectancy. Thus, there is some question about the direction of causality between these two factors. However, regardless of the direction of causality, an implication of Bandura's comments is that effort-performance expectancy may be inversely related to arousal, at least when an individual is highly aroused. Some evidence for a negative relationship between change in effort-performance expectancy and change in arousal was found in the present study. If this relationship is negative, it may have important implications for understanding the relationship between effort-performance expectancy and performance. Because effort-performance expectancy and performance have been shown to be related, many psychologists seem to presume that performance is an increasing monotonic function of effort-performance expectancy as well as incentive. However, if arousal and effort-performance expectancy are inversely related, then it could be possible for an individual's performance to suffer because his or her level of effort-performance expectancy was so high that he or she was not sufficiently aroused.

Three important implications of such a finding would be (1) performance might be a nonlinear (curvilinear in the shape of an inverted U) function of effort-performance expectancy, (2) the relationship between performance and effort-performance expectancy might be mediated, in part, by arousal, and (3) incentive and effort-performance expectancy might have opposite effects on arousal, the former a positive effect, and the latter a negative effect, and

thus, they might have opposite effects on performance, in certain situations. Specifically, if an individual were overaroused, increases in his or her level of incentive might be harmful for performance, while increases in his or her effort-performance expectancy might be beneficial for performance. On the other hand, if an individual were underaroused, increases in his or her level of incentive might be beneficial for performance, while increases in his or her effort-performance expectancy might be harmful for performance. What is desired is to bring the individual to his or her optimal level of arousal, and to do so it may be necessary to consider that effort-performance expectancy and incentive may have countervailing influences on arousal.

Another interesting exploratory finding was the relationships of trait anxiety with arousal and with performance. The high trait anxious swimmers experienced a greater increase in arousal from the regular season to the championship than the low trait anxious swimmers. Also, there was a slight but nonsignificant (at the conventional .05 alpha level) tendency for the high trait anxious swimmers to experience a greater increase in incentive and to improve less from the regular season to the championship than the low trait anxious swimmers. In other words, as with task complexity, the arousal-performance relationship might be moderated by trait anxiety. High trait anxious individuals might be more prone to overarousal than low trait anxious individuals. In which case, the knowledge of trait anxiety would allow one to predict with greater accuracy when high

levels of incentive and accompanying arousal might lead to overarousal and a drop in performance.

While the dynamics of incentive, arousal, and performance may differ for individuals of high or low trait anxiety, they apparently function in a similar manner for the males and females, at least the male and female swimmers in this study. They also appear to function in a similar manner for people of different ages, at least the different ages found in this study (13 to 21). However, the years of experience seem to influence reactions to the championship meet in a predictable fashion. The less experienced swimmers did not improve as much as the more experienced swimmers from the regular season to the championship. Years of experience is somewhat related to ability and the aquisition of important skills, and thus it is not surprising that the more experienced swimmers swam faster. However, their superior ability to improve their times during the championship, suggests that being able to manipulate or control one's incentive and/or arousal is also an important ability or skill, and one possibly related to experience.

In conclusion, the evidence provided by this study seems to justify serious consideration of a revised and expanded notion of the motivation-performance relationship. The relationship between motivation and performance is apparently more complex than suggested by earlier models. The model of the motivation-arousal-performance relationship proposed in this study is a within-subjects model, such

that the relationships between the variables are within-subject relationships. With only two waves of data, it was not possible to examine the model completely within subject. Nonetheless, the results of this study suggest that when an individual becomes directed toward some goal, the individual moves toward that goal with more energy than if he or she was not directed. Thus, it becomes possible for an individual to be so directed (motivated) and thereby energized (aroused) that his or her performance begins to suffer. To the extent that the relationships proposed in this revised model of the motivation-arousal-performance relationship hold true, the ability to predict who will become overaroused (or underaroused) and subsequently suffer performance decrements, and the ability to predict the situations in which this is most likely to occur will be enhanced. Also enhanced will be the ability to understand why performance is suffering, and thus, hopefully, the ability to treat or prevent decrements in performance.

B. Practical Implications

In the previous section, it was suggested that incentive, effort-performance expectancy, and arousal be investigated as separate, though possibly related, facets of motivation when studying the relationship between motivation and performance. In practice, one who desires to motivate himself, herself, or others needs to consider all of these facets of motivation, for all three can potentially influence performance. They may also influence one another. Therefore,

the motivator needs to use these variables in concert with one another. The use of these determinants of performance can be further enhanced by considering the complexity of the task involved and individual difference factors such ability and perhaps trait anxiety and/or years of experience. In this section, incentive, effort-performance expectancy, and arousal are dealt with separately. Then, it is shown how these determinants of performance may be used together.

One important implication from this study is that if an individual is already at an optimal level of arousal or overaroused, increasing incentive does not necessarily lead to better performance. One condition where an individual is more likely to be near his or her optimal level of arousal or overaroused is during the performance of a complex task, Therefore, incentive increases may be more harmful to individuals performing complex tasks than to individuals performing simple tasks, because they are more likely to lead to overarousal. Thus, it is recommended that increasing incentive is a viable strategy for simple tasks, but for complex tasks a more useful strategy would be to try to find a level of incentive that is associated with optimal arousal and performance.

It seems important that the practitioner be aware of what is meant by incentive. In this study, incentive has been defined as a cognitive variable. It is not an external reward or punishment, although incentive may be strongly influenced by external rewards or

punishments. Therefore, if an individual's incentive level was too high and the practitioner wished to lower his or her incentive level, one way would be to reduce the external rewards or punishments. For example, often parents act as motivators in rewarding their children for doing well in school or punishing them for doing poorly. An Associated Press article entitled "Parent Praise, Not Rewards, Works Best to Boost Grades" (February 12, 1986 edition of the Knoxville Journal) reported on a Stanford University study of 7,836 high school students and their parents. It was found that low key, positive reinforcement by the parents was more effective than big, exaggerated responses by the parents. The researchers concluded that creating rewards and punishments can make the students more concerned with the outcomes of their schoolwork than the schoolwork itself. However, it may not be possible or even desirable in many situations to alter the rewards and punishments associated with performance. In these situations, incentive may be lowered by helping the performer reduce the importance of some of the rewards or punishments. For example, when individuals or teams are competing for important prizes, the coaches and participants can often be heard to say, "It is just another game. I am not going to try any harder, just go out and do what I always do." These individuals are trying to lower the valence of the outcomes associated with the contest. By diminishing the importance of the contest, they are attempting to keep the incentive level from getting too high.

While it is desirable to have an individual's incentive level at the point where performance will be maximized, it is difficult to know where this level is for each individual because (1) it may be different for each individual and (2) each individual's level of incentive is subjectively determined. Therefore, for any given task, especially complex tasks where too much incentive may be a problem, it might be helpful for the individual to record his or her level of incentive before numerous performances in order to determine which level of incentive is too high, too low, and optimum. With this information, the individual would be able to employ cognitive strategies or operant conditioning strategies related to incentive with greater success.

Another variable which is presumed to be curvilinearly related to performance is arousal. As with incentive and performance, the arousal-performance relationship is presumably moderated by task difficulty, overarousal being a more likely condition of complex rather than simple tasks. The sports psychology literature contains a great deal of research on methods that enable an individual to control his or her arousal level so that they can improve their performance. Examples include progressive relaxation, biofeedback, visualization, and hypnotism. These methods work best when they are incorporated with practice sessions in order to enhance transference of learning to control arousal to the task situation (Pardine, Oytell, and Napoli, 1981; Zecker, 1982). In order to have a better idea of which level of arousal corresponds with optimum performance for a given task, it

might be helpful for the individual to keep a record of his or her arousal level prior to numerous performances as was suggested with incentive.

Findings in the fields of psychology (Bandura, 1977), organizational behavior (Campbell & Pritchard, 1976), and sport psychology (Taylor, 1987) have provided support for the effectiveness of effort-performance expectancy (sometimes labelled self-efficacy or self-confidence) as a predictor of performance. Bandura has found that the most useful techniques for increasing self-efficacy are performance based as opposed to symbolically based. Bandura (1977, p. 191) stated that, "cognitive processes mediate (behavioral) change but cognitive events are induced and altered most readily by experience of mastery arising from effective performance." In other words, practicing the task or parts of the task that one must perform is more likely to improve effort-performance expectancy than vicarious experience or verbal persuasion, especially when practice leads to performance accomplishment. However, vicarious experience and verbal persuasion can also influence effort-performance expectancy.

Ability and role clarity are two other important determinants of performance. It is important that the practitioner not forget these important variables when attempting to improve someone's performance. While this study has focused on the influence of motivation and arousal on performance, an individual must have the ability to perform

and know what to do and how to do it before motivation or arousal will have any effect on performance.

As mentioned, the facets of motivation may work in concert. For example, training may improve an individual's skills or give the individual a better idea of what he or she is supposed to do. Better skills mean better ability and better performances. Training can also influence effort-performance expectancy. By setting reasonable and reachable goals in training, the individual's effort-performance expectancy is likely to increase, while impossible goals may lead to a decrease in effort-performance expectancy.

Because incentive and effort-performance expectancy may influence arousal differently, the former positively and the latter negatively, they may be manipulated in different ways in order to increase or decrease arousal. For example, when a sports team is faced with an inferior opponent, there may be a tendency for their effort-performance expectancy to be too high (and thus their arousal level too low) and their incentive too low (and thus their arousal level too low). In order to increase incentive and thereby arousal, the coach might consider building up the importance of the game. At the same time, in order to decrease effort-performance expectancy and thereby increase arousal, a coach might consider trying to convince the players that the other team is really quite good. The coach might try to convince the players that the other team's inferior record has been due to bad luck, not inferior ability. Or the coach might try to

lower his or her players confidence. The well known line often given to overconfident players is, "Don't start believing your own press clippings." When facing a superior team, a coach may try the opposite approach, decreasing incentive and increasing effort-performance expectancy in an effort to lower arousal.

Although it is not known exactly how incentive and effort-performance expectancy interact to influence performance, Lawler (1973, p. 52) stated that when one of these variables is zero, the motivation to perform is likely to be zero as well. In other words, motivation is dependent upon some degree of both of these variables. The practitioner needs to know how to manipulate both incentive and effort-performance expectancy, for different individual's may present different challenges. One poor performer may be confident of his or her ability to perform but lack the incentive to perform successfully, while another poor performer may perceive that valued rewards are tied to successful performance but question his or her ability to perform successfully. Although these two individuals are both poor performers, they need to be handled differently in order to improve their motivation and thereby their performance.

In reviewing the practical implications suggested in this section, the practitioner should take care to notice the interplay of factors and the number of factors which can influence performance. Because of the complexity, it is important that the practitioner take an

individual approach, and try to determine how the dynamics of the motivation-arousal-performance model are at work for each individual.

C. Limitations of This Study

The limitations of this study are divided into four sections: threats to statistical conclusion validity, threats to internal validity, threats to construct validity, and threats to external validity. This four way division is taken from Cook and Campbell (1979). They feel that this division is a practical one because the four threats relate to four major questions that must be asked by a researcher:

1. Is there a relationship between the two variables?
2. Given that there is a relationship, is it plausibly causal from one operational variable to the other?
3. Given that the relationship is plausibly causal and is reasonably known to be from one variable to another, what are the particular cause and effect constructs involved in the relationship?
4. Given that there is probably a causal relationship from construct A to construct B, how generalizable is this relationship across persons, settings, and times?

Threats to Statistical Conclusion Validity

There are two ways a statistical conclusion might be invalid. If the relationship beween two variables was being examined and the evidence supported the conclusion that a significant relationship

existed between the two variables when in fact they were not related, a Type I error would have been committed. If the evidence supported the conclusion that a the two variables were not related when in fact they were, a Type II error would have been committed. The threats to statistical conclusion validity will be divided into threats likely to lead to Type I errors and threats likely to lead to Type II errors.

The main causes of Type I errors are violated assumptions to statistical tests and the fishing and error rate problem (Cook & Campbell). Although an alpha level of .05 was used for all four of the major hypotheses and some assumptions may have been violated, by analyzing each of the four major hypotheses a number of different ways and looking for convergence, the problems of violated assumptions and fishing are reduced, because by having several different types of analyses providing the same conclusion, the conclusion is stronger than if only one analysis had been used. Type I errors are more likely to be a problem for the exploratory analyses given the large number of analyses and the constant alpha level of .05.

Although no statistical conclusions were reached regarding the analyses which were corrected for attenuation, the results of these "hypothetical" analyses were used to lend support to a number of the analyses which were not corrected for attenuation. Thus, there may be concerns about their validity. The main concern is the analyses which were corrected for attenuation due to the unreliability of performance. As reported in Table IV-1, test-retest reliabilities of

.84 and .79 were obtained for regular season and championship performance, respectively. These two values were used in estimating change in performance reliability, where a value of .69 was obtained. It is important to distinguish between the reliability of performance and the reliability of the measure of performance. Since performance was measured with a stopwatch, it is likely that the reliability of the of the measure of performance and, hence, change in performance was close to 1.0. Thus, it was probably not necessary to correct for attenuation due to the unreliability of performance or change in performance. Therefore, the relationships which were corrected for attenuation due to the unreliability of performance or change in performance are probably higher than they should be.

The main causes of Type II errors are low statistical power, the use of unreliable measures, unreliable treatment implementation, random irrelevancies in the experimental setting, and random heterogeneity of respondents. These five problems will be discussed in order.

Low statisical power was a threat to this study. With a sample size of approximately 111, nonsignificant results are likely to lead to incorrect conclusions of no relationship. For example, the relationship between change in incentive and change in performance was not significant ($r=-.19$, $p>.05$). However, a larger sample size would have been more likely to have uncovered a relationship of this magnitude. Fortunately, a number of the analyses of the major

hypotheses were significant thus eliminating the question of Type II errors. Unfortunately, the same cannot be said of the exploratory tests.

Another threat which is likely to lead to incorrect conclusions of no relationship is low reliability of the measures. As discussed, change scores are prone to low reliability, as was the measure of change in incentive. With a more reliable measure, perhaps the relationship between change in incentive and change in performance would have been significant. This threat was dealt with statistically by correcting many of the relationships for attenuation due to low reliability. Because there was no estimate of the reliability of effort-performance expectancy, the many nonsignificant results involving this variable may include a number of Type II errors.

Another threat which played a role in this study was the lack of standardization in treatment implementation. Because the questionnaires were administered by different coaches and because the swimmers competed in different regular season meets and different championship meets depending on what team they were on and their performance levels, it was impossible to have perfect reliability of treatment implementation. This threat was partially dealt with by giving the swim coaches identical instructions for collecting data. Also, by luck many of the coaches scheduled several of the same meets for their swimmers. Thus, there was a degree of standardization.

Another threat which was relevant to this study was the random heterogeneity of the subjects. They responded in different ways to the treatment. However, this was expected, and as Cook and Campbell (1979, p. 44) commented, this "threat is reduced when within-subject error terms are appropriate - that is, when they depend not on differences between persons but on differences between occasions of responding within the same persons."

A number of threats to statistical conclusion validity did exist in this study, but by using a within-subject design, by correcting the analyses for attenuation due to low reliability, by using multiple analyses to examine the major hypotheses, and by trying to get a degree of standardization in the implementation of the treatments, many of these threats were reduced to the point where reasonable conclusions could be made about whether the variables used in this study were related to one another or not.

Threats to Internal Validity

Causality or the lack of causality is more difficult to infer from correlational studies than from experiments. As a quasi-experiment, this study stands somewhere in between. For example, because there was not a control group, it is impossible to determine whether or not the changes in incentive, arousal, and performance from the regular season to the championship were due to the treatment or to other factors such as history or maturation. It seems plausible that maturation and/or

history might have played a part in the increase in performance from the regular season to the championship.

With respect to the relationships between change in incentive, change in effort-performance expectancy, change in arousal, and change in performance, it was assumed that performance changes were caused in part by arousal changes and in part by incentive changes. In addition, it was assumed that arousal changes were caused in part by incentive changes and in part by effort-performance expectancy. By analyzing these relationships within-subject, the swimmers acted as their own controls. Thus, many possible confounding variables such as age or ability were controlled for, although it is always possible that a relationship may not be internally valid.

Threats to Construct Validity

Cook and Campbell (1979) explained that relationships between experimental variables does not necessarily mean that the constructs underlying those variables are related. A lack of construct validity could be due to one of two reasons. One reason is that the instruments used may not truly measure the construct they propose to measure. Another reason is that the relationships may have been caused by factors other than the constructs. For example, the subjects might have guessed the purpose of the experiment, in which case, relationships might be caused by the subjects trying to please the

experimenter. These two threats to construct validity will be discussed in light of the current study.

Special care was taken in the operationalization of incentive and arousal. Although the incentive instrument was tailor made, it was made according to the guidelines of theory and past research. Furthermore, it was internally consistent. One weakness of this measure was that no studies were made to test the construct validity of this measure. However, past research has demonstrated that similar incentive measures are effective predictors of effort and performance (Campbell & Pritchard, 1976). The arousal instrument was chosen because its construct validity has been demonstrated in many studies (Katkin, 1978). One weakness of this instrument is that it is not a measure of arousal per se. It is a measure of state anxiety. The justification for using this instrument to measure arousal was based on Martens (1977, p. 5) explanation of the similarities in the concepts of arousal and anxiety and on the wide use of this measure as a measure of arousal in the sports psychology literature. Thus, it was felt that the measures themselves were reasonably construct valid.

Another threat to construct validity besides the measures used is the possibility that the statistical relationships found between variables might have not been caused by the underlying constructs, but by other causes. Two examples of these other causes mentioned by Cook and Campbell (1979) are hypothesis guessing and experimenter expectancies. For example, in this study the swimmers might have

guessed that because an incentive questionnaire was administered before a regular season meet and then again before a championship meet, their incentive was expected to increase. Or the swimmers who perform poorly in championships relative to the regular season might have guessed that they were expected to experience more arousal during the championship than during the regular season. The swimmers were informed that the purpose of this study was to enhance the understanding of the relationship between motivation and performance. The coaches, who administered the questionnaires, were more informed than the swimmers. In order to gain their cooperation in this project, they were told that one of the goals of this study was to find out why some swimmers excelled under the pressures of championship competition while others broke down. If they guessed that break downs were expected to be caused by overarousal or too much motivation, they could have indirectly encouraged the swimmers to respond in line with the hypotheses. These are both possible threats to construct validity. No tests were conducted to examine whether the swimmers or coaches were aware of the major hypotheses of this study. Thus, these two threats, hypothesis guessing and experimenter expectancies, cannot be fully eliminated.

Threats to External Validity

According to Cook and Campbell (1979, p. 73), "Tests of the extent to which one can generalize across various kinds of persons, settings, and times are, in essence, tests of statistical interactions." For

example, if there is an interaction between competition treatment and age, such that only teenagers are subject to the overarousing effects of championship competitions, then the results of this study would not hold across persons of all ages. Cook and Campbell mentioned three threats to external validity: interaction of selection and treatment (as in the example above), interaction of setting and treatment, and interaction of history and treatment. Because this study is concerned with treatments other than swimming competitions, external validity must also include generalizations across treatments, as this treatment was just an example of a wider category of treatments where individuals are asked to perform for larger and larger stakes. It is difficult to generalize the findings of this study across different persons, settings, times, and treatments. Thus the practical implications of this study should be considered cautiously.

More confidence can be placed in generalizations from this study to other groups of high school aged, United States Swim Club swimmers. As noted, increases in incentive generally lead to increases in arousal. Also, for overaroused swimmers, increases in arousal generally lead to decreases in performance and decreases in arousal generally lead to improvements in performance. On the other hand, for swimmers near their optimum arousal level, both increases in arousal and decreases in arousal generally lead to improvements in performance. These results were consistent across all ages, from 13 to 21, and for males and females. However, caution must be exercised even here for the coaching methods of other teams may differ, the championships may

represent different things to different teams, and there may be any number of reasons why these results may be specific to this situation.

D. Suggestions for Future Research

This study only investigated a portion of a revised motivation-arousal-performance model depicted earlier in this chapter. Two types of suggestions will be offered in this section. First, a number of research ideas will be outlined which should serve to build and modify the existing model. Second, several experimental suggestions will be presented which should prove helpful to individual's interested in conducting further research in this area.

An implication of this study is that performance is less likely to be an increasing monotonic function of incentive when a complex task is being performed under highly motivating conditions. This is because (1) highly motivating conditions are more likely to lead to high incentive levels and accompanying high arousal levels and (2) the performance of complex tasks is more susceptible to overarousal than is the performance of simple tasks. Because it is important to know whether too much incentive can impair performance, more studies of motivation and performance need to include complex tasks and highly motivating conditions.

In this study, the evidence tended to support the conclusion that incentive and arousal exert independent influences on performance, and

that optimum performance was related to some moderate level of arousal and some moderate level of incentive (for the complex task performed in this study). It would be useful to explore whether and, if so, how incentive and arousal interact to influence performance. How should these two factors be used together to maximize performance, given the complexity of the task to be performed?

The mechanisms involved in the curvilinear relationship between performance and arousal are hypothesized to be emotional, attentional, physical, and psychological changes brought on by changes in arousal. In future studies of the arousal-performance relationship, it would be useful to know whether these are the mechanisms through which arousal influences performance, and if so, which of the mechanisms is most important, given the task that must be performed. A similar question applies to the mechanisms involved in the incentive-performance relationship and the relationship between effort-performance expectancy and performance.

Further research is needed to explore the relationships between effort-performance expectancy and arousal and between effort-performance expectancy and performance. With respect to the former relationship, effort-performance expectancy and arousal, there is some question about the direction of causality. Do the two factors influence one another? If so, does the causal direction change the nature of the relationship? The answer to those questions will have an impact on our understanding of the relationship between

effort-performance expectancy and performance. Can effort-performance expectancy be too high? Although most studies have found either a positive linear relationship or no relationship (Campbell & Pritchard, 1976), Taylor (1987) found that self-confidence (effort-performance expectancy) was curvilinearly (in the form of an inverted U) related to the performance of fine motor sports. With gross motor sports, however, Taylor found a positive linear relationship. More studies like this one are needed and they need to investigate the role of arousal as an intervening variable. A final comment on the investigation of effort-performance expectancy, the single item measure usually used needs to be improved upon. According to Campbell and Pritchard (1976, p. 89), "the question is most often posed in terms of asking the subject for a subjective probability estimate, the object of the question (i.e., what is meant by performance) varies considerably." Also, Taylor distinguishes between trait self-confidence and state self-confidence. This may add greater understanding to the role played by effort-performance expectancy in the motivation-performance relationship.

So far, studies of incentive and arousal and studies of effort-performance expectancy and arousal have been suggested. Another question that needs to be studied is how effort-performance expectancy and incentive interact to influence the performance of various tasks. As Lawler (1973, p. 52) stated, they should be related in some "basically multiplicative fashion", but what way that is is not known. Also, interactions between all three variables,

effort-performance expectancy, incentive, and arousal, need to be examined for their effect on performance.

It may also be worth investigating the moderating effects of trait anxiety on the arousal-performance relationship. If high trait anxious individuals are more susceptible to the debilitating effects of high incentive levels and high arousal levels than low trait anxious individuals, it may be possible to predict with greater accuracy who will become overaroused. Also, if trait anxiety moderates the arousal-performance relationship, then high trait anxious individuals would make excellent subjects for studying how incentive and arousal can impair performance.

Future studies of the motivation-performance relationship would benefit strongly from examining the subjects at more than one point in time. As noted by Rogosa et al. (1982), it is important to obtain more than two observations on each individual when investigating questions about change. Furthermore, it is useful to measure the motivation variables at many levels, for example, high incentive, low incentive, and moderate incentive, for this is the most effective way of uncovering nonlinear relationships.

This study was successful in providing some support for a revised model of the motivation-performance relationship that includes arousal. Hopefully, this study will serve to stimulate future

research efforts that will add to our understanding of motivation and its relationship to performance.

LIST OF REFERENCES

Bandura, A. (1977). Self efficacy: Toward a unifying theory of behavior change. Psychological Review, 84, 191-215.

Baumeister, R., & Steinhilber, A. (1984). Paradoxical effects of supportive audiances on performance under pressure: The home field disadvantage in sports championships. Journal of Personality and Social Psychology, 47, 85-93.

Bernhaut, M., Gellhorn, E., & Rasmussen, A. (1953). Experimental contributions to the problem of consciousness. Journal of Neurophysiology, 16, 21-35.

Broadbent, D. E. (1971). Decision and stress. New York, NY: Academic Press.

Browne, M., & Mahoney, M. (1984). Sport psychology. Annual Review of Psychology, 35, 604-625.

Campbell, J., & Pritchard, R. (1976). Motivation theory in industrial and organizational psychology. In M. Dunnette (Ed.), Handbook of industrial and organizational psychology. Chicago, IL: Rand McNally.

Chaplin, J., & Krawiec, T. (1974). Systems and theories of psychology. New York, NY: Holt, Rinehart, and Winston, Inc..

Cohen, J. (1977). Statistical power analysis for the behavioral sciences. New York, NY: Academic Press.

Cook, T., & Campbell, D. (1979). Quasi-experimentation: Design and analysis issues for field settings. Chicago, IL: Rand McNally.

Cottrell, N., Wack, D., Sererak, F., & Rittle, R. (1968). Social facilitation of dominant responses by the presence of an audiance and the mere presence of others. Journal of Personality and Social Psychology, 9, 245-250.

Cronbach, L., & Furby, L. (1970). How we should measure "change" or should we? Psychological Bulletin, 74, 68-80.

The Diagram Group. (1976). Man's body: An owner's manual. New York, NY: Bantam Books.

Duffy, E. (1962). Activation and behavior. New York, NY: Wiley.

Easterbrook, J. A. (1959). Effect of emotion on cue utilization and organization of behavior. Psychological Review, 66, 183-201.

Fisher, A. C., & Zwart, E. (1982). Psychological analysis of athletes' anxiety responses. Journal of Sport Psychology, 4, 139-158.

French, J., & Magoun, H. (1952). Effects of chronic lesions in central cephalic brain stem of monkeys. Archives of Neurological Psychiatry (Chicago), 68, 591-601.

Gould, D., Horn, T., & Spreeman, J. (1983). Sources of stress in junior elite wrestlers. Journal of Sport Psychology, 5, 159-171.

Hebb, D. (1966). A textbook of psychology. Philadelphia, PA: W. B. Saunders.

Hency, T., & Glass, D. (1968). Evaluation apprehension and the social facilitation of dominant and subordinate responses. Journal of Personality and Social Psychology, 10, 446-454.

Ingram, W. R. (1956). The hypothalamus. Clinical Symposia, 8, (Whole No.4). Ciba Pharmaceutical Products, Inc..

Johns G. (1981). Difference score measures of organizational behavior variables: A critique. Organizational Behavior and Human Performance, 27, 443-463.

Katkin, E. (1978). State-trait anxiety inventory. In Oscar Buros (Ed.), The eighth mental measurements yearbook. Highland Park, NJ: Gryphon Press.

Kenny, D. (1975). A quasi-experimental approach to assessing treatment effects in the nonequivalent control group design. Psychological Bulletin, 82, 345-362.

Lacey, J., & Lacey, B. (1958). Verification and extention of the principle of autonomic response-stereotypy. American Journal of Psychology, 71, 50-73.

Landers, D. (1977). Motivation and performance: The role of arousal and attentional factors. Proceedings of the National College Physical Educational Association for Men Annual Meeting, Orlando, Florida, January 1977.

Lawler, E. (1973). Motivation in work organizations. Monterey, CA: Brooks/Cole Publishing.

Lindsley, D. (1957). Psychophysiology and motivation. In M. R. Jones (Ed.), Nebraska symposium on motivation 1957. Lincoln, NB: University of Nebraska Press, 44-105.

Lindsley, D., Bowden, J., & Magoun, H. (1949). Effect upon the EEG of acute injury to the brain stem activating system. Electroencephalography and Clinical Neurophysiology, 1, 475-486.

Linn, R. L., & Slinde, J. (1977). The determination of the significance of change between pre- and posttesting periods. Review of Educational Research, 47, 121-150.

Lord, F. (1963). Elementary Models for measuring change. In C. W. Harris (Ed.), Problems in measuring change. Madison, WS: University of Wisconsin Press.

Lord, F. (1974). Significance test for a partial correlation corrected for attenuation. Educational and Psychological Measurement, 34, 211-220.

Lord F., & Novick, M. (1968). Statistical theories of mental test scores. Reading, MA: Addison-Wesley Publishing Co..

Lowe, R., & McGrath, J. (1971). Stress, arousal, and performance: Some findings calling for a new theory. Project Report, AF 1161-67, AFOSR.

Martens, R. (1977). Sport competition anxiety test. Champaign, IL: Human Kinetics Publishers.

Mitchell, T. (1982). Motivation: New directions for theory, research, and practice. Academy of Management Review, 7, 80-88.

Nadler, D., & Lawler, E. (1979). Motivation: A diagnostic approach. In R. Steers & L. Porter (Eds.), Motivation and work behavior. New York, NY: McGraw-Hill Book Co..

Nideffer, R. (1979). The role of attention in optimal athletic performance. In P. Klavora & J. Daniel (Eds.), Coach, athlete, and the sport psychologist (pp. 99-112). Champaign, IL: Human Kinetics.

Nideffer, R. (1981). The ethics and practice of applied sport psychology. Ithaca, NY: Mouvement Publications.

Nie, N., Hull, C., Jenkins, J., Steinbrenner, K., & Bent, D. (1975). Statistical package for the social sciences. New York, NY: McGraw-Hill Book Co..

Oxendine, J. (1970). Emotional arousal and motor performance. Quest, 13, 23-32.

Pardine, P., Oytell, R., & Napoli, A. (1981). Transfer benefits of biofeedback: A research note. Perceptual and Motor Skills, 52, 373-374.

Parent praise, not rewards, works best to boost grades. (1986). Knoxville Journal, February 12, 1986.

Pierce, W., & Stratton, R. (1981). Perceived sources of stress in youth sports participants. In G. C. Roberts & D. Landers (Eds.), Psychology of motor behavior and sport. Champaign, IL: Human Kinetics.

Porter, L., & Lawler, E. (1968). Managerial attitudes and performance. Homewood, IL: Dorsey Press.

Powell, F., & Verner, J. (1982). Anxiety and performance relationships in first time parachutists. Journal of Sport Psychology, 4, 184-188.

Rogosa, D., Brandt, D., & Zimowski, M. (1982). A growth curve approach to the measurement of change. Psychological Bulletin, 92, 726-748.

Samuels, I. (1959). Reticular mechanisms and behavior. Psychological Bulletin, 56, 1-25.

Schlenker, B. (1980). Impression management. Monterey, CA: Brooks/Cole.

Schlenker, B. (1982). Translating actions into attitudes: An identity-analytic approach to the explanation of social conduct. In L. Berkowitz (Ed.), Advances in experimental social psychology. New York, NY: Academic Press.

Schwartz, G., Davidson, R., & Goleman, D. (1978). Patterning of cognitive and somatic processes in the self-regulation of anxiety: Effects of meditation versus exercise. Psychosomatic Medicine, 40, 321-328.

Scott, W. (1966). Activation theory and task design. Organizational Behavior and Human Performance, 1, 3-30.

Spielberger, C. (1966). Theory and research on anxiety. In C. Spielberger (Ed.), Anxiety and behavior. New York, NY: Academic Press.

Spielberger, C. (1972). Conceptual and methodological issues in research on anxiety. In C. Spielberger (Ed.), Anxiety: Current trends in theory and research, Vol. 1. New York, NY: Academic Press.

Spielberger, C., Gorsuch, R., and Lushene, R. (1970). STAI manual for the state-trait anxiety inventory. Palo Alto, CA: Consulting Psychologists Press.

Steers, R., & Porter, L. (1979). Motivation and work behavior. New York, NY: McGraw-Hill Book Co..

Taylor, J. (1987). Predicting athletic performance with self-confidence and somatic and cognitive anxiety as a function of

motor and physiological requirements in six sports. Journal of Personality, 55, 139-153.

Thompson, R. (1975). Introduction to physiological psychology. New York, NY: Harper & Row.

Vroom, V. (1964). Work and motivation. New York, NY: Wiley.

Worden, F., & Livingston, R. (1961). Brain stem reticular formation. In D. Sheer (Ed.), Electrical stimulation of the brain (pp. 263-276). Austin, TX: University of Texas Press.

Yerkes, R., & Dodson, J. (1908). The relation of strength of stimulus to rapidity of habit-formation. Journal of Comparative Neurological Psychology, 18, 459-482.

Zajonc, R., & Sales, S. (1966). Social facilitation of dominant and subordinate responses. Journal of Experimental Social Psychology, 2, 160-168.

Zecker, S. (1982). Mental practice and knowledge of results in the learning of a perceptual motor skill. Journal of Sport Psychology, 4, 52-63.

APPENDIXES

APPENDIX A: MOTIVATION MEASURES

Social and Self-Mastery Incentive

In the current study, social and self-mastery was measured with a tailor made questionnaire. A copy of the two page questionnaire appears on the next two pages. A brief overview is given here of the psychometric properties of this instrument.

Item Development: Each item in this instrument is a product of the valence of an outcome multiplied by the performance-outcome expectancy of the same outcome. Outcome valence was scored on a five point scale from one (extremely important) to five (unimportant). However, this scale was altered to zero (unimportant) to four (extremely important) for the purpose of computing item scores, as it was important that higher valences be associated with higher values. Performance-outcome expectancy was scored on an eleven point scale from 0% (will never occur) to 100% (guaranteed to occur).

A pilot study was conducted to test the viability of this instrument. Forty-five swimmers were administered this questionnaire before a regular season meet and before a championship meet. An item analysis revealed that two of the items failed to significantly correlate with the total social and self-mastery incentive score for both the regular season and the championship. The two items were the products of the following two outcomes: (1) if I swim some of my

THESE QUESTIONS REFER TO YOUR BEST EVENT

Outcomes associated with having some of your fastest times in your best event during this weekend's meet.	How important is it to you to obtain the outcomes listed on the left? (extremely important / very important / important / somewhat important / unimportant)	If you have some of your fastest times in your best event during this weekend's meet, how likely is it that the outcomes listed on the left will occur? (will never occur / 50-50 / guaranteed to occur)
1. My teammates will congratulate me.	1 2 3 4 5	0% 20% 40% 60% 80% 100%
2. I will experience feelings of pride and personal accomplishment.	1 2 3 4 5	0% 20% 40% 60% 80% 100%
3. I will score points for my team.	1 2 3 4 5	0% 20% 40% 60% 80% 100%
4. My coach(es) will praise me.	1 2 3 4 5	0% 20% 40% 60% 80% 100%
5. My opportunities to participate in future competitions will <u>increase</u>.	1 2 3 4 5	0% 20% 40% 60% 80% 100%
6. I will be <u>more</u> admired by my teammates.	1 2 3 4 5	0% 20% 40% 60% 80% 100%
7. I will finish in first place.	1 2 3 4 5	0% 20% 40% 60% 80% 100%
8. My parents will praise me.	1 2 3 4 5	0% 20% 40% 60% 80% 100%
9. I will feel <u>more</u> confident in my swimming abilities.	1 2 3 4 5	0% 20% 40% 60% 80% 100%
10. I will feel very happy.	1 2 3 4 5	0% 20% 40% 60% 80% 100%
	Circle the appropriate response.	Circle the appropriate point between 0% and 100%.

THESE QUESTIONS REFER TO YOUR BEST EVENT

Outcomes associated with <u>failing</u> to have some of your fastest times in your best event during this weekend's meet.	How important is it to you to <u>avoid</u> the outcomes listed on the left? (extremely important / very important / important / somewhat important / unimportant)	If you <u>fail</u> to have some of your fastest times in your best event during this weekend's meet, how likely is it that the outcomes listed on the left will occur? (will never occur ↓ 50-50 ↓ guaranteed to occur ↓)
1. I will look bad in front of the spectators.	1 2 3 4 5	0% 20% 40% 60% 80% 100%
2. I will feel like I have let my teammates down.	1 2 3 4 5	
3. I will fail to score points for my team.	1 2 3 4 5	
4. My coach(es) will criticize me.	1 2 3 4 5	
5. I will fail to qualify for important meets in the future.	1 2 3 4 5	
		0% 20% 40% 60% 80% 100%
6. My coach(es) will be disappointed in me.	1 2 3 4 5	
7. I will not finish in first place.	1 2 3 4 5	
8. My teammates will tease me.	1 2 3 4 5	
9. My parents will be disappointed in me.	1 2 3 4 5	
10. I will give up swimming.	1 2 3 4 5	
	Circle the appropriate response.	0% 20% 40% 60% 80% 100% Circle the appropriate point between 0% and 100%.

fastest times in my best event during this meet, I will be more admired by my teammates and (2) if I fail to swim some of my fastest times in my best event during this meet, I will give up swimming. In the interest of homogeneity, these two items were not used when determining the overall social and self-mastery incentive score.

Reliability: This questionnaire was only administered once for each experimental condition, once during the regular season and once during the championship. Thus, no test-retest reliabilities were obtained. However, Cronbach's alpha coefficients were computed to assess internal consistency. For the pilot study, alpha coefficients of .77 (regular season) and .88 (championship) were obtained. In the current study, alpha coefficients of .82 (regular season) and .86 (championship) were obtained.

Validity: No validity studies were undertaken. However, this instrument was constructed according to the theoretical guidelines of expectancy theory. Furthermore, past research which has made use of similar instruments has shown them to be effective predictors of effort and performance.

Effort-Performance Expectancy

In the current study, effort-performance expectancy was measured with a single item. This item appears on the following page labelled as question 8.

PLEASE ANSWER THE FOLLOWING QUESTIONS BEFORE YOU COMPETE.

1. Name _____. 2. Age _____.

3. Sex _____.

4. How many years have you been swimming competitively? _____.

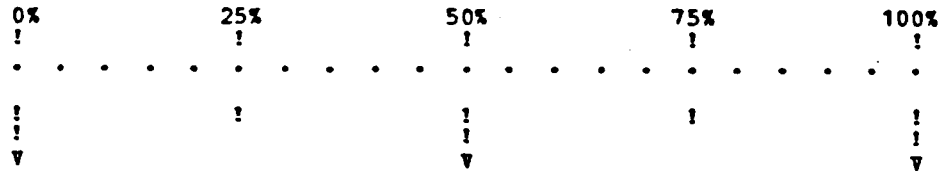
5. What is your best event? _____.

6. What is your fastest time in your best event during practice? _____.

7. What is your fastest time in your best event during competition? _____.

8. If you try hard in this weekend's competition, how likely is it that you will swim some of your fastest times in your best event?

Circle the appropriate point between 0% and 100%.



No matter how hard I try, I will not swim some of my fastest times.

The odds are about even, 50-50, that if I try hard I will swim some of my fastest times.

If I try hard, I am guaranteed to swim some of my fastest times- without a doubt.

APPENDIX B: THE AROUSAL MEASURE

The State Section of the State-Trait Anxiety Inventory

In the current study, the State section of the State-Trait Anxiety Inventory (SAI) was used to measure arousal. Two copies of this instrument appear on the next two pages. Two versions of this instrument were used. One version dealt with a swimmer's feelings immediately before beginning a race. This version was administered following a regular season race and following a championship race. The other version dealt with present feelings. This version was administered prior to a practice session. A brief overview is given here of the psychometric properties of this instrument.

Reliability: Test-retest correlations for the SAI are usually low. Spielberger, Gorsuch, and Lushene (1970, p. 9) explained, "Given the transitory nature of anxiety states, measures of internal consistency such as the alpha coefficient would seem to provide a more meaningful index of reliability of A-State scales than test-retest correlations." Spielberger et al. (1970) reported alpha coefficients ranging from .83 to .92 with higher values when the SAI was given under conditions of stress. In the current study, for the regular season, an alpha coefficient of .88 was obtained, and for the championship, an alpha coefficient of .87 was obtained. These results are consistent with Spielberger's findings.

The State Section of the State-Trait Anxiety Inventory

Administered Following a Swim Meet

THE QUESTIONS BELOW ARE CONCERNED WITH HOW YOU FELT BEFORE PARTICIPATING IN THE LAST HEAT OF YOUR BEST EVENT.

NAME _____. EVENT _____.

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate response to the right of the statement to indicate how you felt immediately before the starter said, "Swimmers take your mark." There are no right or wrong answers. Do not spend too much time on any one statement, but give the answer which seems to best describe your feelings at the time.

	Not at all	Some-what	Moder-ately so	Very much so
1. I felt calm.	1	2	3	4
2. I felt secure.	1	2	3	4
3. I was tense.	1	2	3	4
4. I was regretful.	1	2	3	4
5. I felt at ease.	1	2	3	4
6. I felt upset.	1	2	3	4
7. I was worrying about possible misfortunes.	1	2	3	4
8. I felt rested.	1	2	3	4
9. I felt anxious.	1	2	3	4
10. I felt comfortable.	1	2	3	4
11. I felt self-confident.	1	2	3	4
12. I felt nervous.	1	2	3	4
13. I was jittery.	1	2	3	4
14. I felt "high strung".	1	2	3	4
15. I was relaxed.	1	2	3	4
16. I felt content.	1	2	3	4
17. I was worried.	1	2	3	4
18. I felt over-excited and "rattled".	1	2	3	4
19. I felt joyful.	1	2	3	4
20. I felt pleasant.	1	2	3	4

The State Section of the State-Trait Anxiety Inventory

Administered Before a Practice Session

SELF-EVALUATION QUESTIONNAIRE

Developed by C. D. Spielberger, R. L. Gorsuch and R. Lushene

STAI FORM X-1

NAME _____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you *feel* right now, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
1. I feel calm	①	②	③	④
2. I feel secure	①	②	③	④
3. I am tense	①	②	③	④
4. I am regretful	①	②	③	④
5. I feel at ease	①	②	③	④
6. I feel upset	①	②	③	④
7. I am presently worrying over possible misfortunes	①	②	③	④
8. I feel rested	①	②	③	④
9. I feel anxious	①	②	③	④
10. I feel comfortable	①	②	③	④
11. I feel self-confident	①	②	③	④
12. I feel nervous	①	②	③	④
13. I am jittery	①	②	③	④
14. I feel "high strung"	①	②	③	④
15. I am relaxed	①	②	③	④
16. I feel content	①	②	③	④
17. I am worried	①	②	③	④
18. I feel over-excited and "rattled"	①	②	③	④
19. I feel joyful	①	②	③	④
20. I feel pleasant	①	②	③	④

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Validity: Spielberger et al. (1970) reported significant differences in mean state anxiety scores for students in four treatment groups. The treatments, in order of reported state anxiety, were: a movie depicting accidents in a woodworking shop; taking an intelligence test; a normal condition; and relaxation training.

Another piece of evidence reported by Spielberger et al. (1970) was the fact that state anxiety scores correlated better with trait anxiety scores under stressful conditions, under conditions which pose a threat to self-esteem, or under conditions where personal adequacy is evaluated. In these situations, the high trait anxious person should, theoretically, experience more state anxiety.

Finally, state anxiety scores are essentially unrelated to achievement measures, such as high school rank or grade point average, or intelligence, such as the Army Beta.

APPENDIX C: TRAIT ANXIETY MEASURES

In the current study, three instruments were used to measure trait anxiety. Copies of these three instruments appear on the next three pages in the following order: the Sport Competition Anxiety Test, the Trait Section of the State-Trait Anxiety Inventory, and the Nervousness scale. The last instrument was measured with a single item. The swim coaches were asked to indicate the nervousness of each swimmer before competition.

ILLINOIS COMPETITION QUESTIONNAIRE

Form A

Directions: Below are some statements about how persons feel when they compete in sports and games. Read each statement and decide if you HARDLY-EVER, or SOMETIMES, or OFTEN feel this way when you compete in sports and games. If your choice is HARDLY-EVER, blacken the square labeled A, if your choice is SOMETIMES, blacken the square labeled B, and if your choice is OFTEN, blacken the square labeled C. There are no right or wrong answers. Do not spend too much time on any one statement. *Remember* to choose the word that decribes how you *usually* feel when competing in *sports and games.*

	Hardly-Ever	Sometimes	Often
1. Competing against others is socially enjoyable.	A ☐	B ☐	C ☐
2. Before I compete I feel uneasy.	A ☐	B ☐	C ☐
3. Before I compete I worry about not performing well.	A ☐	B ☐	C ☐
4. I am a good sportsman when I compete.	A ☐	B ☐	C ☐
5. When I compete I worry about making mistakes.	A ☐	B ☐	C ☐
6. Before I compete I am calm.	A ☐	B ☐	C ☐
7. Setting a goal is important when competing.	A ☐	B ☐	C ☐
8. Before I compete I get a queasy feeling in my stomach.	A ☐	B ☐	C ☐
9. Just before competing I notice my heart beats faster than usual.	A ☐	B ☐	C ☐
10. I like to compete in games that demand considerable physical energy.	A ☐	B ☐	C ☐
11. Before I compete I feel relaxed.	A ☐	B ☐	C ☐
12. Before I compete I am nervous.	A ☐	B ☐	C ☐
13. Team sports are more exciting than individual sports.	A ☐	B ☐	C ☐
14. I get nervous wanting to start the game.	A ☐	B ☐	C ☐
15. Before I compete I usually get up tight.	A ☐	B ☐	C ☐

Trait Section of the State-Trait Anxiety Inventory

SELF-EVALUATION QUESTIONNAIRE

STAI FORM X-2

NAME _____ DATE _____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
21. I feel pleasant	①	②	③	④
22. I tire quickly	①	②	③	④
23. I feel like crying	①	②	③	④
24. I wish I could be as happy as others seem to be	①	②	③	④
25. I am losing out on things because I can't make up my mind soon enough	①	②	③	④
26. I feel rested	①	②	③	④
27. I am "calm, cool, and collected"	①	②	③	④
28. I feel that difficulties are piling up so that I cannot overcome them	①	②	③	④
29. I worry too much over something that really doesn't matter	①	②	③	④
30. I am happy	①	②	③	④
31. I am inclined to take things hard	①	②	③	④
32. I lack self-confidence	①	②	③	④
33. I feel secure	①	②	③	④
34. I try to avoid facing a crisis or difficulty	①	②	③	④
35. I feel blue	①	②	③	④
36. I am content	①	②	③	④
37. Some unimportant thought runs through my mind and bothers me	①	②	③	④
38. I take disappointments so keenly that I can't put them out of my mind	①	②	③	④
39. I am a steady person	①	②	③	④
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	①	②	③	④

Nervousness Scale

[redacted] SWIM CLUB Coach's Name _____.

Directions: Please indicate the extent to which the swimmer gets nervous or anxious during competition.	extremely nervous ▼		somewhat nervous ▼		not at all nervous ▼
1. [redacted]	1	2	3	4	5
2. [redacted]	1	2	3	4	5
3. [redacted]	1	2	3	4	5
4. [redacted]	1	2	3	4	5
5. [redacted]	1	2	3	4	5
6. [redacted]	1	2	3	4	5
7. [redacted]	1	2	3	4	5
8. [redacted]	1	2	3	4	5
9. [redacted]	1	2	3	4	5
10. [redacted]	1	2	3	4	5
11. [redacted]	1	2	3	4	5
12. [redacted]	1	2	3	4	5
13. [redacted]	1	2	3	4	5
14. [redacted]	1	2	3	4	5
15. [redacted]	1	2	3	4	5
16. [redacted]	1	2	3	4	5
17. [redacted]	1	2	3	4	5
18. [redacted]	1	2	3	4	5
19. [redacted]	1	2	3	4	5

APPENDIX D: CORRECTING R^2'S FOR ATTENUATION

In order to determine the incremental R^2 of change in incentive, the following F test (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975, p. 339) was used:

$$F = \frac{(R^2\ y.12) - (R^2\ y.1)}{(1 - R^2\ y.12) / (N-k-1)} \qquad (1)$$

where:

y = $\triangle$Performance — N = sample size

1 = $\triangle$Arousal — k = # of independent variables

2 = $\triangle$Incentive — d. of f. = 1 and (N-k-1)

In order to correct these F tests for attenuation, it was necessary to first convert the R^2's to zero order correlations so the following equation for correcting a relationship for attenuation (Lord & Novick, 1968, p. 70) could be used:

$$r12 = \frac{r12}{\sqrt{r11\ r22}} \qquad (2)$$

The R^2's in equation 1 were converted to zero order correlations by using the following two equations for a squared partial correlation (Nie et al., 1975, pp. 332-333):

$$r^2y1.2 = \frac{(ry1 - ry2\ r12)^2}{(1 - r^2y2)\ (1 - r^212)} \qquad (3)$$

$$r^2y1.2 = \frac{R^2\ y.12 \ - \ R^2\ y.2}{1 \ - \ R^2\ y.2} \qquad (4)$$

Assuming that $R^2y.2$ is equal to r^2y2, the following equation was derived from equations 3 and 4:

$$R^2\ y.12 =$$

$$\frac{(r^2y1 - 2(ry1\ ry2\ r12) + r^2y2\ r^212)}{(1 - r^212)} \ + \ r^2y2 \qquad (5)$$

Equation 5 was in turn substituted into equation 1 to produce:

$$F = \frac{\dfrac{(r^2y1 - 2(ry1\ ry2\ r12) + r^2y2\ r^212)}{(1 - r^212)}}{1 - \dfrac{(r^2y1 - 2(ry1\ ry2\ r12) + r^2y2\ r^212)}{(1 - r^212)} + r^2y2 / (N-k-1)} \quad (6)$$

Finally, equation 2 was used to correct the correlations and the squared correlations in equation 6 for attenuation so that the incremental R^2 of incentive could be estimated, given perfectly reliable measures. Two examples of how equations 2 and 6 were combined appear below.

in equation 6	becomes in the final equation
ry1	$\dfrac{ry1}{\sqrt{ryy\ r11}}$
r^2y1	$\left(\dfrac{ry1}{\sqrt{ryy\ r11}}\right)^2$

APPENDIX E: FULL CORRELATION MATRIX

The Pearson correlations between the nineteen variables measured in this study appear on the this and the next two pages.

Variable	1	2	3	4	5	6	7	8	9
1. Incentive 1	---								
2. Incentive 2	.75*	---							
3. △Incentive	-.24*	.46*	---						
4. Practice Arousal	-.24	-.04	.23	---					
5. Arousal 1	.00	-.02	-.02	.37*	---				
6. Arousal 2	-.10	.11	.28*	.29*	.39*	---			
7. △Arousal	-.09	.12	.27*	-.12	-.56*	.55*	---		
8. Performance 1	-.10	-.04	-.01	-.28*	-.19	-.10	.09	---	
9. Performance 2	.08	-.05	-.20	-.22	.00	-.20	-.17	.48*	---
10. △Performance	.10	-.02	-.19	.01	.19	-.12	-.25*	-.37*	.64*

* $p < .05$

Variable	1	2	3	4	5	6	7	8	9
11. Expectancy 1	.14	.11	.00	-.05	-.12	.08	.17	.06	.13
12. Expectancy 2	.15	.32*	.12	.02	.10	.00	-.05	-.16	.14
13. △Expectancy	.00	.07	.10	.11	.17	-.06	-.22*	-.23*	-.14
14. Gender (M=1, F=2)	.33*	.33*	.00	.03	.17	-.04	-.20*	-.02	-.09
15. Age	-.21*	-.13	.14	-.06	-.02	-.05	-.02	.32*	.26*
16. Years Experience	-.07	-.18	-.03	.02	.04	.01	-.01	.06	.27*
17. Trait Anxiety	-.08	.03	.14	.56*	.49*	.40*	-.13	-.06	-.07
18. Sports Competition Anxiety	-.04	.06	.11	.38*	.43*	.44*	.00	-.14	-.21
19. Nervousness	.26*	.18	.07	.11	.14	.19	.06	-.30*	-.22

* $p < .05$

Variable	10	11	12	13	14	15	16	17	18
10. △Performance	---								
11. Expectancy 1	.02	---							
12. Expectancy 2	.29*	.36*	---						
13. △Expectancy	.10	-.68*	.44*	---					
14. Gender (M=1, F=2)	-.05	-.11	.09	.20	---				
15. Age	.02	-.37*	-.24*	.18	-.17	---			
16. Years Experience	.24*	-.17	-.10	.05	-.06	.32*	---		
17. Trait Anxiety	-.02	.04	.04	.04	.24	-.12	-.15	---	
18. Sports Competition Anxiety	-.06	-.13	.05	.19	.14	-.09	-.04	.57*	---
19. Nervousness	.00	.03	.00	.09	.20	-.06	-.15	.23	.34*

* $p < .05$

APPENDIX F: INFORMED CONSENT FORMS

Two informed consent forms were used in this study: one form for the swimmers and one form for the parents of the swimmers under eighteen years of age. Copies of the two forms appear on the following pages.

INFORMED CONSENT

Dear Swimmer,

I am a graduate student at the University of Tennessee at Knoxville in the Industrial/Organizational Psychology Program. I have received permission from your swim coach to conduct a study of the effects of competition on swimmers' motivation, arousal, and anxiety.

This study represents my dissertation research for my Ph.D. Thus, I would be very pleased if you could take part in the study. However, if you feel that it is not in your best interest to participate in this study, I would certainly understand. Participation is completely voluntary. You would not be penalized in any way by failing to take part. Also, you would be free to withdraw from the study at any time.

In order for you to make an informed decision, I would like to elaborate on the purpose of this study and the procedures that will be involved. Two implications of motivation research are to make rewards contingent on performance and to use rewards that are meaningful to the individual. However, I have experienced situations (e.g., certain competitive sport situations) where the rewards involved were so motivating that my performance was impaired. The purpose of this study is to enhance understanding of the relationship between motivation and performance.

In order to accomplish the above objective, the swimmers in this study will be asked to answer four questionnaires: a motivation questionnaire, a state anxiety questionnaire, a trait anxiety questionnaire, and a sport competition anxiety questionnaire.

The motivation questionnaire will be administered twice, once before a regular season meet and once before a championship meet. The state anxiety questionnaire will be administered twice, once after a regular season meet and once after a championship meet. The sport competition anxiety questionnaire and the trait anxiety questionnaire will be administered before a practice session. These questionnaires will be collected by the swim coaches. I have asked the coaches not to look at their swimmers' answers, but to return the questionnaires directly to me.

After I have collected all the data, I will transcribe the data to computer cards and destroy the original data so that it will be impossible to identify the responses of any one swimmer. However, I will report back to each individual swimmer his or her individual scores and what they mean before destroying the questionnaires.

I hope you are not alarmed by these measures to protect your confidentiality. The questionnaires will ask personal questions, but nothing as sensitive as questions about sexual behavior or as incriminating as questions about illegal behavior or drug use. As a psychologist, I am bound by professional ethics to guard the

confidentiality of all subjects in any study, regardless of the level of sensitivity of the information.

While this study will not help to improve your swim times during the current summer season, I believe that the results of this study can help you and your coach to better understand how to deal with and prepare for competitive situations. I will share my findings with all of the teams who participated.

Below you will find my address and phone number and those of the two individuals who are serving as chairmen of my dissertation. Please feel free to contact me if you have any questions about this study. Also, please feel free to contact either of the two professors with questions about this study or or about the rights of research subjects.

Dr. Mike Rush and
Dr. John Larsen, Jr.
Stokeley Management Center
University of Tennessee
Knoxville, TN 37996
(615) 974-3161

George B. Yancey
2101 Laurel Ave.
Apartment #7
Knoxville, TN 37916
(615) 522-3662

I give my consent for my participation in this study with the understanding that I may withdraw at any point.

Please sign here: _____.

INFORMED CONSENT

Dear Parent(s),

I am a graduate student at the University of Tennessee at Knoxville in the Industrial/Organizational Psychology Program. I have received permission from your child's swim coach to conduct a study of the effects of competition on swimmers' motivation, arousal, and anxiety.

This study represents my dissertation research for my Ph.D. Thus, I would be very pleased if your child could take part in the study. However, if you feel that it is not in your child's best interest to participate in this study, I would certainly understand. Participation is completely voluntary. Your child would not be penalized in any way by failing to take part. Also, your child would be free to withdraw from the study at any time.

In order for you to make an informed decision, I would like to elaborate on the purpose of this study and the procedures that will be involved. Two implications of motivation research are to make rewards contingent on performance and to use rewards that are meaningful to the individual. However, I have experienced situations (e.g., certain competitive sport situations) where the rewards involved were so motivating that my performance was impaired. The purpose of this study is to enhance understanding of the relationship between motivation and performance.

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I hope you are not alarmed by these measures to protect your child's confidentiality. The questionnaires will ask personal questions, but nothing as sensitive as questions about sexual behavior or as incriminating as questions about illegal behavior or drug use. As a psychologist, I am bound by professional ethics to guard the

confidentiality of all subjects in any study, regardless of the level of sensitivity of the information.

While this study will not help to improve your child's swim times during the current summer season, I believe that the results of this study can help your child and your child's coach to better understand how to deal with and prepare for competitive situations. I will share my findings with all of the teams who participated.

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Knoxville, TN 37916
(615) 522-3662

As the parent (or legally authorized representative) of

_____,

I give my consent for his/her participation in this study with the understanding that he/she may withdraw at any point.

Please sign here: _____.

VITA

George Braungart Yancey was born and raised in Atlanta, Georgia. He attended the Westminster Schools from kindergarden through the twelfth grade, from which he graduated in 1973. He obtained his undergraduate education at Davidson College and received a Bachelor of Arts degree with a major in psychology in 1977.

In the fall of 1978, he entered the Industrial/Organizational Psychology Program at the University of Tennessee. While a student, he was employed with the University of Tennessee as a data analyst for Constuction Resources Analysis, as a personnel analyst for the Office of Personnel Services, and as a research analyst for the Energy and Environment Resources Center, with the Tennessee Valley Authority as a research analyst for the Office of Equal Opportunity Compliance and as a social science analyst for the Personnel Research and Analysis Branch, and with Goodwill Industries as a career counselor. He also acted in a consulting capacity for the Industrial Relations Department of North American Philips Consumer Electronics Corporation. He received his Doctor of Philosophy degree in the summer of 1987.